American Machinist

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Mobilization Planning

At Rock Island Arsenal

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Commanding, Rock Island Arsenal, Ill.

IN THE event of another national emergency the task has been assigned to Rock Island Arsenal of manufacturing, reconditioning, and shipping large quantities of ordnance material that will be required to supply the armies in the field. Up to the present time 53 separate production schedules have been allocated to this arsenal, 38 of which are for the manufacture of complete gun carriages, rifles, recoil mechanisms, and miscellaneous replacement parts for artillery material and tractors.

The greater part of the work on the emergency orders must be completed and shipped during the first year. The magnitude of the work involved in preparing the mobilization plans for the arsenal so that manufacture can proceed on short notice is seen from an examination of only a few of the orders. In one order alone 325 different components and assemblies are included, for each of which a route sheet has been written. The very nature of ordnance material makes it of intricate manufacture, and one of these route sheets alone, which covers the manufacture of a gun-cradle forging, takes up 119 sheets in outlining the 80 operations.

The manufacture of the complete material on the war order mentioned within the allotted time of two years will require 425 machine tools, 2,650,000 pounds of materials, and 9,130 jigs, fixtures, dies, gages, and special tools. On this order alone, 540 workmen will be engaged, besides the foremen and supervisors. It is estimated that to accomplish the emergency work allotted to Rock Island Arsenal will require a greater number of employees than the peak number reached during the World War, which was in excess of 15,000. The present estimates provide for 250 superintendents, foremen and assistant foremen to be assigned to the shops in time of emergency to handle the work. In addition, 3 regular army officers and 87 reserve officers will be required to oversee the manufacture, and 15 additional reserve officers will be at the arsenal depot for the receiving and issuing of ordnance. The estimated cost of the material to be manufactured, which is to be covered by the emergency plans, is in excess of 35 million dollars.

The present facilities at Rock Island Arsenal for the supply of power, light, heat and water are ample to cover the requirements for any probable war needs. The machine tool installations are also sufficient, and

Fig. 1—Turret lathe department, Rock Island Arsenal

there are adequate buildings for all purposes with the exception of heat treating, assembling and office space. A typical interior view is shown in Fig. 1. It is presumed, of course, that as equipment becomes obsolete with the passage of time it will be replaced.

The Ordnance Department has assigned orders to the arsenal in accordance with a schedule of finished material requirements based on the War Department requirements for equipping an army. All calculations for supply of finished material are made from a theoretical "M day," or date of mobilization. The arsenal, in turn, schedules from the part drawings the components in the order of their requirement for assembly into the completed piece of ordnance, and the manufacture is arranged accordingly. When an order for an assigned delivery after M day is received, the arsenal prepares lists of parts, route sheets, and bills of material, determines the requirements for machine tools, small tools, jigs, fixtures and gages, and also the requirements for personnel of various classes to do the work. The route sheet is the basis from which all of the arsenal war manufacturing plans are made, and these must be written up before the work can proceed. The completeness of the information given on these route sheets can be judged from the sample sheet shown in Fig. 2. Beside the description of the work to be done on each operation and the layout of equipment needed, the route sheet shows the exact location in the arsenal where the work will be done, and the time in hundredths of an hour that it takes to complete each operation.

The second stage in the planning of war orders is the preparation of a "List of Parts and Progress Sheet," which is designed to give full information

SF 330 ROCK ISLAND ARSENAL — 10-22-25—5000

FCG/hb. 10-22-25. 5 Sheets - #1.

ROUTE SHEET PIECE SYMBOL 2-97-71B

NAME OF PIECE SHAFT, RANGE SCALE

Drg. 2-97-71. Recoil Mechanism, 75 M/M Gun Carriage, M 1917M1 (French).

MATERIAL Carbon Steel, W.D. 1050 (Spec. 87-107) Ft. Quenched and Drawn, 1-5/8" diam. x 2-13/32" long = one piece. (One required per vehicle.)

APPROX. TIME PER PIECE	PRICE PER 100	MACHINE GROUP	LOCATION	OPERATION NUMBER AND DESCRIPTION	
.135			RM201B	1. Chuck bar stock, rough and finish turn the 15.97 M/M (#6287) diameter finish turn the oil recess 15.8 M/M (#6220) diameter, form 1.5 M/M (#0591) radius and finish face flange, drill 2 M/M (#0787) oil hole and drill for taper hole, rough and finish ream taper hole, finish turn the 14 M/M (#5512) diameter, 1.5 M/M wide groove and radius at shoulder, rough and finish chase the 14 M/M (#5512) x 1.5 M/M Pitch (Fr.) thread, cut off 89.5 m/m (2#3425) long.	
		M26		#6 Warner & Swasey Turret Screw Machine.	
				Acorn Die, Roughing, 14 M/M x 1.5 M/M Pitch (Fr.)	ST3LB-62H1
				" " , Finishing, " " " " " "	ST3LB-62H2
				Taper Drill	ST2LB-65H5
				" Reamer	PRC-574
				Snap Gage, 15.97 M/M - 15.92 M/M	PRC-292
				Thread Ring, 14 M/M x 1.5 M/M Pitch (Fr.)	PRC-477
				Test Tool Range Scale Shaft #1	PRC-469
.150			RM201B	2. Chuck on the 15.97 M/M (#6287) diameter, rough and finish turn the 17.98 M/M (1#4953) and 16 M/M (#6299) diameter, finish face flange, drill and ream the 6 M/M (#2362) diameter hole, finish bore to #257 diameter, 9 M/M (#3543) deep, tap 8 M/M x 1 M/M Pitch (Art.) thread, rough and finish chase the 16 M/M x 1.5 M/M Pitch (Art.) thread.	

Fig. 2—Sample route sheet

regarding the name and symbol of each component, the drawing on which it is found, the total quantity of the part necessary for assembly, and the quantity and sizes of raw material required. It will be noted on the sheet, Fig. 3, that an expenditure order number is given to each order received from the Ordnance Department. This is for proper distribution of the charges against the work, and for general identification. A sub-order number is also assigned at the arsenal to each component or to a separate assembly. The sub-order, in the event of an emergency, authorizes the manufacture of the specified number of the parts, and is also an authority under the same conditions for drawing the required raw material from the storeroom.

Material summary sheets have been prepared for each piece of material, from which a bill of material is made up for each war order. This bill of material itemizes the sizes and total weights of raw materials that will be needed for the manufacture of the equipment. When all of the war orders to be handled by the arsenal are planned, a total material summary sheet will be prepared showing the total material required to be purchased, and the required delivery dates as calculated from M day.

In order to determine in advance the machinery equipment required on the war orders, together with the man-hours necessary for the work, and the class and number of mechanics and machine operators to be hired, operation sheets, shown in Fig. 5, are being prepared to cover all machines. This information is deduced from the data already given on the list of

EX. ORDER 519 L1-306

FOR THE MANUFACTURE OF 36 SETS OF REPLACEMENT PARTS FOR 75 M/M GUN CARRIAGE, M1897M1 (FRENCH). (SECTION NO. 2)

Lathe Turret, Warner and Swasey No. 6
MACHINE

10043 — U.S. NUMBER

DM201B — LOCATION

ROUTE SHEET NO.	OPER. NO.	PRODUCTION HR.	PRODUCTION DAY	QUANTITY REQUIRED	TIME FOR THIS LOT, DAYS	REMARKS
1151	1	7.5	150	756	5 5/6	

2 Operators, Lathe (Turret)

Entered on Machine Summary Sheet

11/6/25-K

Fig. 4—A specimen operation sheet

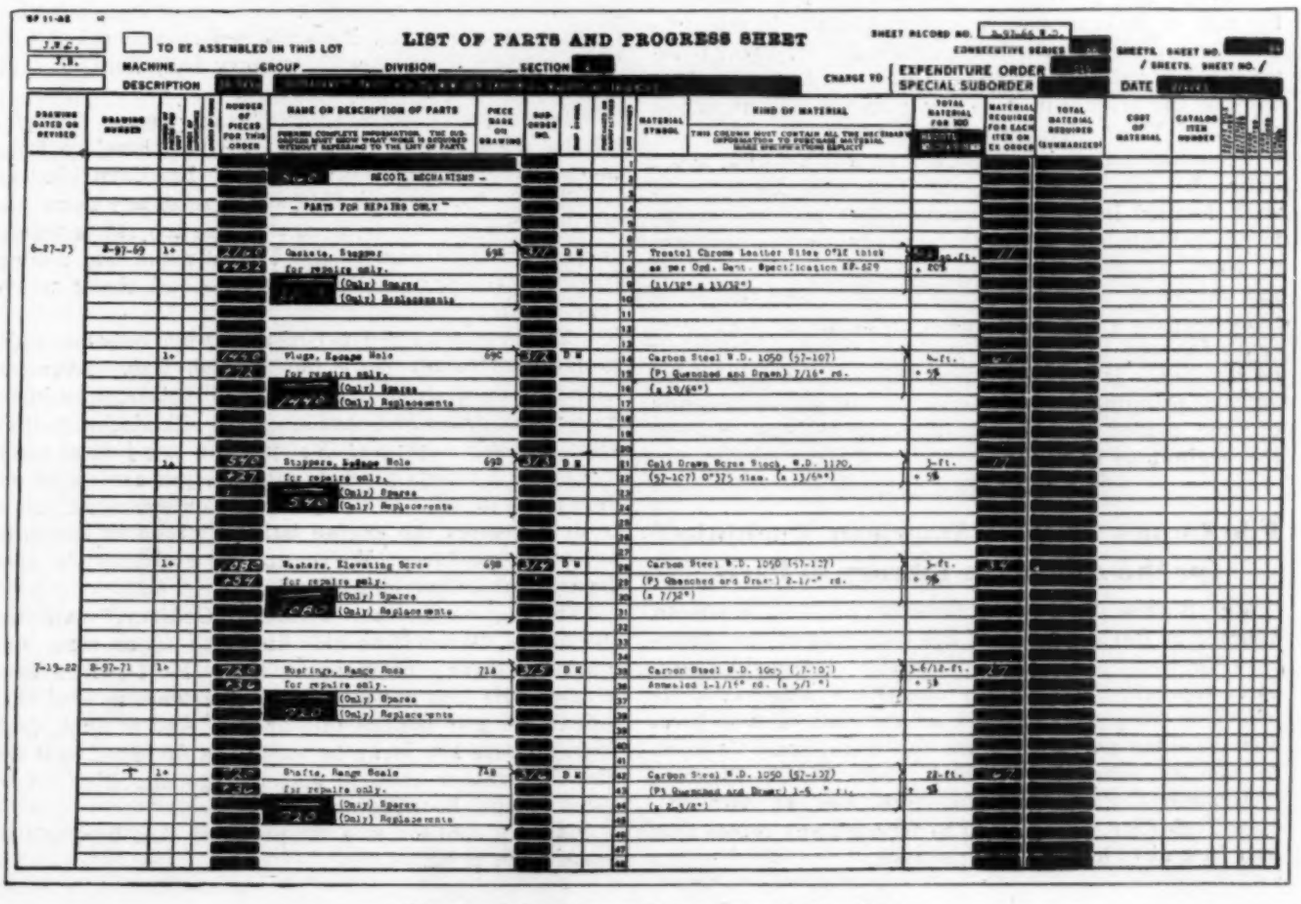


Fig. 3—A basic record for arsenal planning

parts and on the route sheet, but is here assembled in a convenient form for the purpose. The daily production is figured on a basis of 20 hours' work, under the assumption that in war time the arsenal will be operated on two 10-hour shifts daily. The month is considered on a basis of 25 working days.

The information on the operation sheets is finally assembled against the machines on which the operations are to be done, and a machine tool summary sheet is being prepared for every machine in order to schedule the time of the machine and to avoid interference of operations or overcrowding of the machine equipment. It has been assumed that operators cannot be hired and trained quickly enough to man all machines to capacity at once, so it is planned to double shift the most essential ones at first and gradually increase the force until all necessary machines are operating 20 hours daily at the end of three months. The time of starting a component part in manufacture is calculated back from the date after M day that the part is needed for assembling. From these machine tool summary sheets a statement can eventually be deduced containing the exact number of each type of machine that will be required for the arsenal equipment to handle all war orders.

At the time of preparation of the operation sheets the requirements for special tools are entered on tool sheets. These sheets are sent to the central tool storage where a check is made of the quantity available, and the information noted on the sheet. Tools, fixtures, or gages that are listed as short by the tool storage department are entered on a shortage list in order to provide for their manufacture at an early date.

Systematic Economy

Enough has been given to indicate the extent of the task of making adequate advance plans in preparation for a possible war-time emergency. The war planning is carried along systematically with the regular work of the arsenal in such a way as to avoid an undue expense. When the present war plans are completed and summarized the arsenal will at any time on short notice be able to furnish the Ordnance Department with detailed information on machines and tool equipment available and needed to carry out a given program of work, as well as to furnish an exact statement of raw materials needed at given periods. The personnel requirements will also be known in detail, so that labor confusion and interference with draft regulations will be avoided. It is hoped that the present scheme of advance planning for an emergency will prevent the loss of time, money and lives that has in the past marked the beginnings of all wars.

File Copies of the "American Machinist" for the American Library in Paris

Mr. Burton Stevenson, director of the American Library in Paris, finds that his back files of the *American Machinist* are short many issues. He would, therefore, appreciate having any subscriber who has a file of copies from 1918 to 1926, or any part of that time, and who has no further use for them, send them on to him to complete his files. Mr. D. E. Bigelow, McGraw-Hill Publishing Co., 10th Ave. at 36th St., New York City, will be glad to forward any copies that may be sent to him for this purpose.

Getting Fooled on Averages

By John R. Godfrey

"AVERAGES are funny birds, Godfrey," said Old Man Johnson the last time I saw him. "You can make 'em tell you most any sort of a story you want and it's mighty easy to get fooled unless you watch your step. I've had a couple of examples lately that sort of jarred me a bit and set me to thinking.

"Ran across an old pal of mind, Bill Sturgis, who started a little shop back in the old home town and still sticks to his job. I asked Bill how things were going.

" 'Fine' " he said, " 'business expanding. Had to increase my force fifty per cent last week.' " " 'And how big a shop have you now Bill?' "

" 'Three men',' says Bill.

"That fifty per cent sounded just as big as though his shop was as big as ours. And I'm not sure but Bill is just as happy. But it showed me that you've got to take percentages and averages with several grains of salt unless you know all the circumstances.

"Then my second jolt came when Tom jacked me up about some old lathes we had. We've been buying more new machines than we ever dreamed of a few years ago and I was kidding myself that everything was fine and I might draw a few hundred in dividends the next quarter.

"We'd had an expert figure-juggler make us a report that showed the average age of the whole machine equipment. I'd been real proud of that report and had patted myself on the back, several pats, over the statement that the average age of the equipment was under 7 years.

"And then son Tom comes along and takes all the joy out of life by asking for some new engine lathes. So I trotted out Mr. Expert's report and asked him 'How come? Lathes can't be very bad, Tom,' I said, 'when they average under 7 years.'

" 'Seven years my eye, Dad,' says Tom. " 'You're talking about the whole shop. I'll bet there's a lathe there that Noah had in the Ark. I'm darn glad he didn't have two because I'd hate to raise any more like 'em. We've got lathes there that are too old to vote—and ought to be pensioned. They'd make fine decorations for the inside of the cupola—and that's where they belong.

" 'The engine lathe department has had only one addition to the family since the Spanish war. Averages look nice on a sheet to show the directors, who know more about drugs and shoe laces and silk stockings than they do about machines. But you can lose just as much money on a twenty-year-old lathe as you can on an old drill press in spite of fancy reports on averages. Next to drill presses the engine lathe is probably the most neglected machine. We've got to get busy in that department before long, Dad.'

"There goes another dividend, Godfrey," said the Old Man. "When Tom gets his mind set on some new machines there's no stopping him. He'd rather have a new lathe this minute than get a 'hole in one' that I hear the golf hounds talk about. And at that, Godfrey, I guess I'm lucky to pass up a dividend to a son like that rather than to spend it getting him out of some scrape, bootlegging or otherwise."

Old Man Johnson is a bit proud of that boy, and he has a right to be.

How Conveyors Saved Erecting New Buildings

By Fred H. Colvin
Editor, *American Machinist*

A system of conveyors that helps all departments—Product so well handled as to permit consolidating another department with existing plant, without adding new buildings

CONVEYORS can be used in so many ways and for so many reasons that they must be viewed from many angles. While they are not a panacea for all shop ills, there are few places where they cannot be used to advantage in production shops for one reason or another. The problem is to find the reason.

One reason frequently advanced is the saving in inventory, because a much smaller quantity of partly finished work is necessary to secure a steady flow of the finished product. In the case of The Robbins & Myers Co., Springfield, Ohio, however, the primary reason lay at the other end of the business — storage. By the former plan, the electric fans and similar products, were manufactured in one plant and trucked to a warehouse from which they were shipped to customers. The warehouse was located near the Mad River, which on occasions lives up to its name and gets rid of its surplus energy by flooding buildings along its banks.

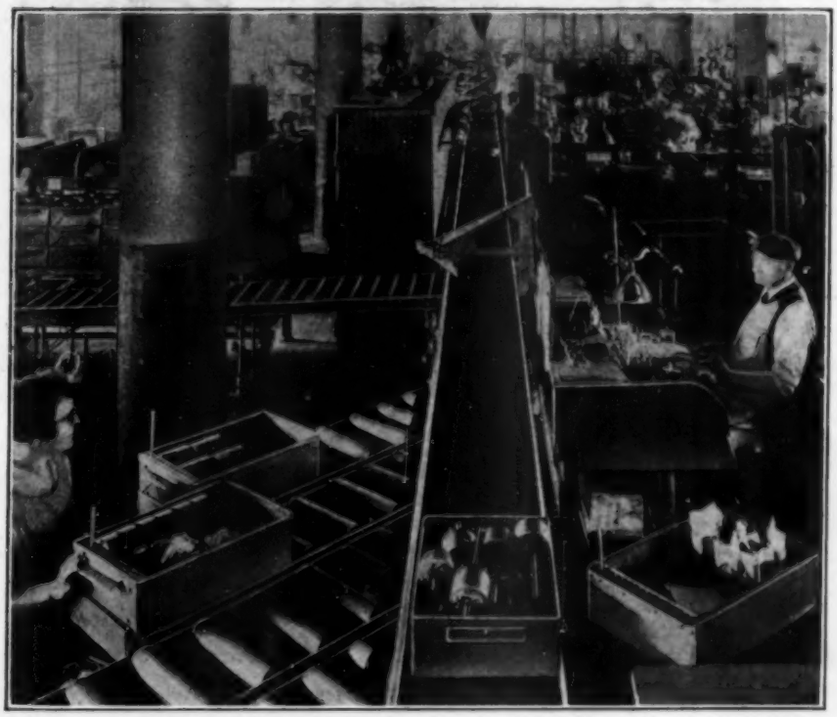
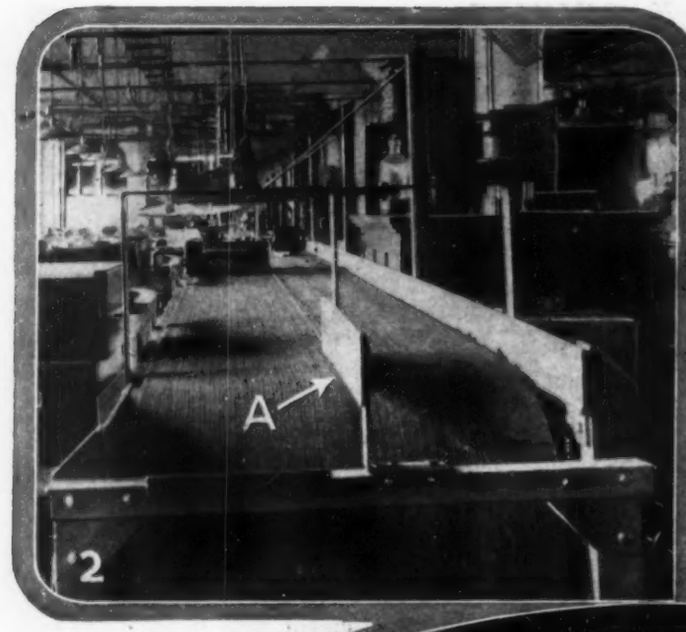


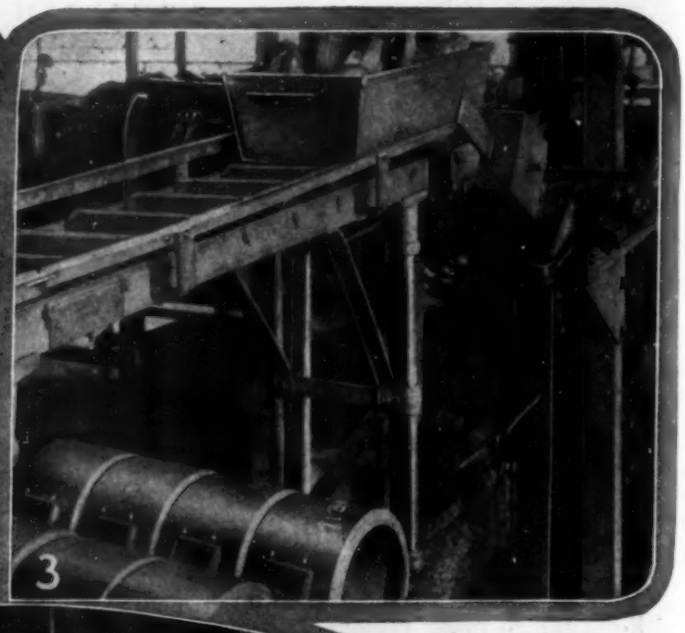
Fig. 1—Long conveyor belt, loading spurs and side tracks

The loss from floods became such a serious question that new warehouses on higher ground were contemplated. After careful consideration, however, it was decided to invest part of the cost in conveyor installations, in the belief that they would tend to make less storage necessary. The results obtained have justified the decision. The decreased amount of material in process has saved sufficient floor space to handle the packing and shipping of motors and fans, and the necessity for warehouse space has been largely overcome. The saving in investment, both in buildings and in material, as well as the speeding up of production, has worked out very satisfactorily.

A few of the conveyor applications are shown in the accompanying illustrations, although they by no means show the entire equipment. The belt conveyor shown in Fig. 1 is perhaps typical of the method used for handling such units as armatures and fields. The belt, as can be seen, runs practically the entire length of the building. The pan of armatures on the conveyor has come from the other end of the line. At the left are four spur tracks from which pans conveying field coils and other parts are fed on the conveyor belt and started down the shop. At frequent intervals there are gravity side tracks at right angles to the main conveyor. Over the conveyor belt is a series of arms carrying switch plates, or plows. At one end of each pan there is a row of holes for switching- or control-pins as seen on the spurs. The location of the pin at the end of the pan determines the point at which the tray will be switched off the belt, the plows being so set as to allow all pins to pass except those so placed as to insure contact at that station. The pan that is switched, rolls down the side track and awaits the operator.

A modification of this method is the use of the double-width belt shown in Fig. 2, serving operators on each


A
2


3

A
A
4

5

side. The framework at the end makes it easy to keep the material for each side in its proper place. The division plate makes an anchor for one end of the cable *A* that prevents parts from one side working over to the other. In this case there is being conveyed a pan on the left side and a motor on the right. For handling material from one floor level to another the Lamson elevator in Fig. 3 is used. These elevators have suspended carriers on which pans or trays are placed, on the "up" side, where they remain till they go over the top and

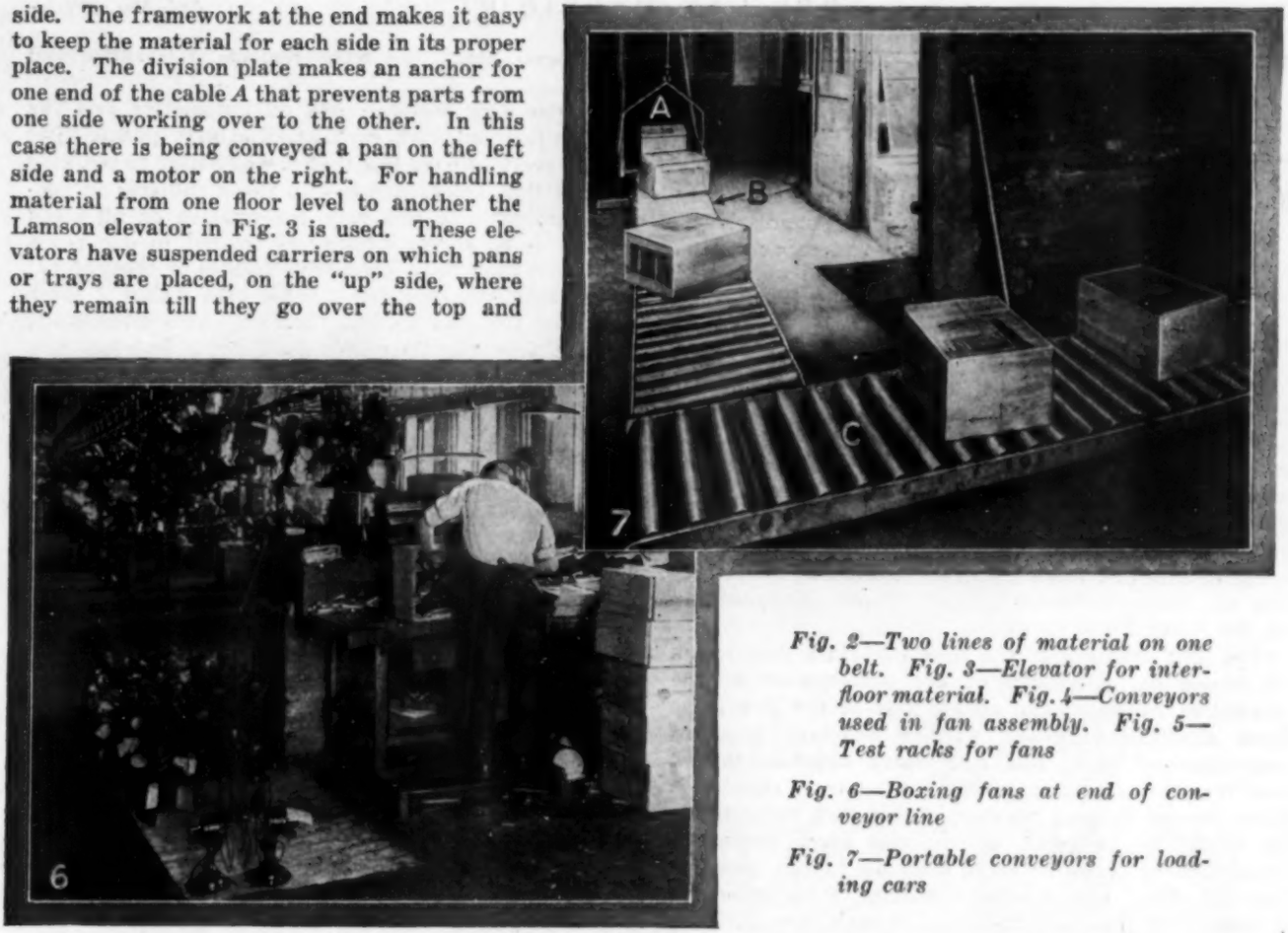


Fig. 2—Two lines of material on one belt. Fig. 3—Elevator for interfloor material. Fig. 4—Conveyors used in fan assembly. Fig. 5—Test racks for fans

Fig. 6—Boxing fans at end of conveyor line

Fig. 7—Portable conveyors for loading cars

reach the desired floor on the "down" side. Fig. 3 shows a pan being removed and about to roll down the incline to a conveyor at right angles to it, not shown.

For assembly and shipping the electric fans, which are an important part of the product, conveyors also play an important part. In the assembling department the overhead, continuous conveyor is used as in Fig. 4. There are two of these conveyors, each independent, but in the adjoining sides at the center both sets of carriers are moving toward the reader. The assembly starts in the center, the units being hung on racks that consist of light wooden bars equipped with suitable hooks to hold any of the parts.

As an operator completes a part, he hangs it on the hook nearest his hand. The comparatively short racks solve the problem of turning the corners, since the end motion allowed by the hangers as at *A*, makes it easy for the suspending link to accommodate itself to the angularity of the bar at the corner.

Assemblers take work from the ever-moving rack and replace the parts thereon after they have been assembled, thus keeping the benches clear of all parts but the ones being worked on, and facilitating the handling of the work.

At the other end of the double conveyor are the test racks, as in Fig. 5, one being at the delivery end of each line of work. Testers pick a completed fan from the rack, plug it into the receptacle connected with the proper voltage and current, and the fan is run during its passage to the delivery end. The speed of the test rack is such that each fan gets an hour's run. Fans wound for special voltages and currents are tested on the table in the center between the regular test racks.

The two outer racks converge, bringing the delivery ends near together in order that a single conveyor of the overhead type can carry them to the boxing department as in Fig. 6. Beneath this conveyor is a second test rack for such fans as may not have passed quite 100 per cent in the first test. The completed fans are taken from the rack overhead and boxed as shown, the box shooks and all packing material being conveniently arranged to avoid the necessity for extra movements and labor. The fans on the floor would seem to indicate that the assembly had run a little ahead of the packing department.

Conveyors are also used to carry boxed apparatus of all kinds to the shipping platform, as in Fig. 7. A chute *A* brings the boxes to the roller conveyor *B*, which is portable and runs into the freight car itself. Gang planks on each side make it easy for men to get in and out of the car with safety. Nor do the conveyors stop here. Another portable section at *C* aids in moving the boxes to the ends of the car and eliminates a lot of unproductive and unnecessary labor. These conveyors enable the men to load the cars quickly and with little fatigue, and form a logical adjunct to the conveyors shown in the various departments of the shop.

"More light and less glare" would make a good motto for the engineer who is responsible for lighting the shop. Accurate work requires more light than we usually find, but glare may easily cause errors and rejections.

Book Reviews

Railways of South America, Part I, Argentina. By George S. Brady, American Trade Commissioner. Two hundred sixty-seven, 6x9 pages, paper covers. Fifty-three illustrations, two appended maps, and many tables. Indexed. Published by the Bureau of Foreign and Domestic Commerce as Trade Promotion Series No. 32. Sold by the Superintendent of Documents, Government Printing Office, Washington, D. C. Price 50 cents.

The Argentine Republic has more than half of the railway mileage of South America, and this book treats of the 60 separate lines with a total of about 24,000 miles. It is the first time that complete information on the railroads of that part of the world has ever been collected into one volume, and the study was made during six years residence of the Trade Commissioner in the River Plate countries.

The first chapters of the book contain a description of Argentina, a history of the development of the Argentine railways, and an analysis of the Argentine laws affecting railroads. Other chapters treat of organization, labor, fuel and water supplies, tariffs, and the purchase of materials. A separate chapter is then devoted to each railway, giving such information as might be required by railroad men, engineers, financiers, or manufacturers desiring to sell goods to the railroads. Comparative statistics of operation for a number of years are tabulated in each case, giving a more accurate idea of the present status of the roads. Names of managing and operating officials, and details of rolling stock, shops and line are given. The book should be useful to anyone interested in the finance, construction, or supply of materials to South American railroads.

American Machinists' Handbook, Fourth Edition— Fred H. Colvin and Frank A. Stanley. 972 pages, 4½x7 in. Published by the McGraw-Hill Book Co., 370 Seventh Ave., New York City. Price $4.

To one who has not kept in close touch with the progress of machine practice since 1920, a study of the contents of the fourth edition will prove something of a revelation. A comparison of the third and fourth editions shows that much of the older material has been abandoned as obsolete, and in its place is the latest information obtainable on the same subjects. This is particularly noticeable in the sections devoted to screw threads; pipe threads; bolts, nuts and screws; and measurements and fitting. The latest tables are given in each case, some of the new standards being less than a year old. Tolerances on screw threads are given for the first time. The fitting of metal parts for interchangeable work also receives detailed attention and allowances and tolerances are given for all kinds of fits that are used in machine work. The new British standards for both screw threads and metal fits are given, as well as the new bolt and nut tables used in Great Britain.

Among the new material are concise data on both flame and arc welding; new information on grinding with the new standards for wheels, spindles and guards; more complete gearing tables; and suggestions on spiral bevel gears, pin measurements, tolerances, and so on.

The two new sections, one on automotive and the other on railroad work, seem small at first glance. The authors seem to have felt that it was better to put only material that referred solely to these subjects in separate sections. In this way, information on all kinds of bolts is together; welding is treated in one place, whether it deals with locomotive frames or other work; and so with other subjects. This plan makes it much easier for the user to find what he wants although it makes it necessary to consult the index to find just how much there is on each subject.

The Dictionary of Shop Terms has been largely rewritten and there are new illustrations of all the machine tools shown, in order to illustrate new designs. The widespread use of the book is shown by the sale of 210,000 copies of the first three editions. The contents of the new edition should make it even more popular than the previous ones.

Commerce Yearbook, 1925. Compiled by the Bureau of Foreign and Domestic Commerce. Seven hundred fifty-two pages, 6x9 in., heavy cloth boards. Cross Indexed. Published by the Government Printing Office, and sold by the Superintendent of Documents, Washington, D. C. Price $1.

The preparation of this yearbook has become one of the regular features of the Department of Commerce since 1922, and the 1925 edition is a most complete encyclopedia of the commerce and trade of the world. The book is copiously illustrated with charts, tables and maps. The conditions of trade during 1925 in the domestic markets are thoroughly analyzed, and separate chapters deal with such subjects as production and marketing of raw materials, agricultural products, dairy and poultry products, coal and coke, petroleum, metals, automotive products and leather goods. The subjects of finance and banking, transportation, telephones and telegraph, and other matters bearing on domestic and foreign commerce, are treated in detail. One hundred and fifty-five pages at the end of the volume are taken up with the economic and trade conditions in various countries of the world. Sixty-four countries and political divisions of the world are treated separately. A feature of the book is that statistics are given in comparison with those of other years and with prewar figures, so that an exact idea can be obtained of present trends. The book should be in every business library.

Mathematics for Engineers. By Raymond W. Dull, Consulting Engineer. 780 pages, 5½x8 inches. Illustrated by numerous diagrams. Bound in cloth boards. Published by McGraw-Hill Book Co., Inc., New York City. Price $5.

Here is a volume that should prove useful to engineers in all the various fields. It combines in one book the various kinds of mathematics that the engineer needs on occasion, and in such form that he does not have to work out intermediate steps to get what he wants. It starts with plain numerical computations and goes on through algebra, logarithms, determinants, geometry, trigonometry, conics and calculus. A number of examples are included to illustrate the text. There is an index of subjects but none of the usual tables have been brought in.

Repair shops of Argentine State Railways

A corner of the workshops of the Argentine Government railways at Tafí Viejo, in the heart of South America, 900 miles northwest of Buenos Aires. These shops occupy 42 acres, employ 1,900 workmen, and contain more than 300 machine tools.

Railways of the Argentine Republic

MORE than half of the railroad mileage of South America lies in the Argentine Republic, and represents an investment of more than $1,500,000,000. Something over 75 per cent of this capital was put in by British investors, and another $135,000,000 by the French. The ownership of these lines has been a great boon to European manufacturers who have found them a fertile consuming field for quantities of machinery, rolling stock, and general mechanical supplies.

American manufacturers, however, have in the past been able to sell locomotives, cars and machine tools freely to the State-owned lines of the country, and to some extent have outbid the European manufacturers in selling to their own lines, especially on points of delivery or technical service. While the major purchases of the European-owned railways of South America are handled through London or Paris, there is nevertheless ample opportunity for American manufacturers of machinery and railway equipment to place their goods with these companies.

One notable point in connection with the Argentine railways is that they have experienced good earnings, and as a consequence have generally been in a position to keep their equipment up to a high standard. The recovery after the war depression was rapid, and for the past three years most of the lines have been carrying out programs of expansion and of renewal of their rolling stock and equipment. The Argentine railroad shops are mostly well equipped, and due to their isolated position from the source of material are often fitted to do more manufacturing work than is done in the average American railway shop. Plans are being studied for the construction of large new shops for the state railways that will handle large scale repair and construction work for all of the Argentine Government lines. These shops will be located at Santa Fe.

The history of Argentine railroads dates back to 1853, and a number of very able European engineers and railroad administrators have been associated with the lines. The engineering details and new equipment purchases for practically all of the British-owned railroads in the River Plate region are passed on by a widely known firm of consulting engineers in London, and the mechanical and electrical features of the lines have been of a high order. Another notable feature is the fact that the European-owned railways, although administrated from home offices, have been able to avoid serious troubles with native labor and contentions with the government throughout the seventy years of operation.

The primary railroads are of three gages, the Russian broad gage of 5 ft., 6 in., the standard 4 ft., 8½ in., and the Argentine meter gage. The lines of different gages are laid out in zones so that there is little manual transfer of freight arising from the variety of gages. In the ports and terminals 3-rail systems are employed for shunting the broad and meter gage rolling stock over the same tracks.

The mechanical departments of the railroads in all cases operate shops. These shops are primarily for repair work, but large scale erecting is done on equipment sent overseas in sections, and in a few of the shops car building is done on a fair scale. The shops also build equipment for the maintenance-of-way departments, and they make up all crossovers and switches. All of the principal shops have iron and brass foundries, but depend upon mills in Buenos Aires for steel castings. Both gas and electric-arc welding are done on an extensive scale, and because of the high cost of imported materials the shops have possibly resorted to the salvaging of worn parts by welding more than would be advisable in local American shops.

The locomotive shops of the Central Argentine Railroad at Perez cover 69 acres and handle 28 locomotives a month, besides the erection of 50 new steel freight cars and the repair on 60 steel freight cars a month.

Information taken from "Railways of South America, Part I, Argentina," by George S. Brady, American Trade Commissioner. Published by the United States Department of Commerce. 267 pp.

The Primary Railroads of Argentina

Name of Railway	Mileage, Main Line	Nationality	Gage	No. of Locomotives	No. of Cars	Location of Shops	No. of Men in Shops
Buenos Aires Southern	4,718	British	5 ft., 6 in.	782	14,826	Remedios	2,700
Buenos Aires Pacific	2,611	British	5 ft., 6 in.	584	9,852	Junin	2,500
Central Argentine	3,305	British	5 ft., 6 in.	695	19,996	Rosario	3,325
Buenos Aires Western	1,882	British	5 ft., 6 in.	348	8,210	Liniers	1,700
Rosario to P. Belgrano	513	French	5 ft., 6 in.	45	1,128	Villa Diego	160
San Antonio	469	State	5 ft., 6 in.	22	316	San Antonio	.....
Comodoro Rivadavia	124	State	5 ft., 6 in.	7	82	C. Rivadavia	.....
Puerto Deseado	178	State	5 ft., 6 in.	11	195	Deseado	.....
North East Argentine	754	British	4 ft., 8½ in.	64	1,201	Monte Caseros	.....
Entre Rios	729	British	4 ft., 8½ in.	90	2,282	Parana	400
Central of Buenos Aires	292	Argentine	4 ft., 8½ in.	45	797	Lynch	.....
Diamante to Federal	104	State	4 ft., 8½ in.	12	166	.....	.....
North Central Argentine	3,291	State	Meter	596	9,661	Tafi Viejo	1,900
Central Cordoba	1,206	British	Meter	271	7,045	Alta Cordoba	1,100
Midland	322	British	Meter	39	878	Libertad	225
Formosa	186	State	Meter	5	208	Formosa	....
Province of Santa Fe	1,188	French	Meter	171	5,973	Santa Fe	425
Buenos Aires Provincial	402	Provincial	Meter	33	949	La Plata	.....
General of Buenos Aires	790	French	Meter	104	2,666	Buenos Aires	400
Central of Chubut	168	State	Meter	9	119	Madryn	.....
Rafaela Steam Tramway	53	British	Meter	6	53	Rafaela	.....
Argentine Transandine	112	British	Meter	29	234	Mendoza	.....
Rosario to Fuentes	31	State	Meter	1	59	.....	.....
San Nicolas	34	State	Meter	...	....	.....	.....
Port of Buenos Aires	76	State	3-rail	27	572	Buenos Aires	.....
Port of La Plata	41	State	3-rail	5	130	La Plata	.....
Port of Rosario	40	French	3-rail	14	92	Rosario	.....

The Perez shops, which were built in 1912, are modern throughout, and rank with the best mechanical workshops in South America. The shops of the Southern Railway employ 2,700 men, but have not been modernized. There are, however, 551 machine tools in the shops, and the work undertaken is of great variety. Plans are now under way for the erection of new buildings, and complete reorganization of the workshops. The machinery equipment of the British-owned railway shops is largely of British manufacture, but that of the State Railway shops is made up a large variety of American, British, German, and French machines.

Apprenticeship courses are in operation in all of the large Argentine railroad shops. The foremen are almost invariably sent out from the home offices, but the laborers, mechanics, gang bosses, and frequently assistant foremen, are recruited locally. It has been found possible to find good journeymen machinists, foundrymen, blacksmiths, and wood workers amongst the large Italian population of the country. It has also been possible to obtain a supply of young men trained at the national manual training schools that are located in all of the large centers.

The freight cars now being acquired by the British-owned roads are of all-steel construction, and are assembled in Argentina. These freight cars vary from the 10-ton light European car to the heavy 50-ton American type. The Central Argentine Railway brings out its passenger coaches in three sections, and assembles them in the Rosario workshops. The Southern Railway is now building all of its passenger and baggage coaches at the Remedios de Escalera shops. In the accompanying table the mileage and extent of mechanical equipment of the primary railroads is shown.

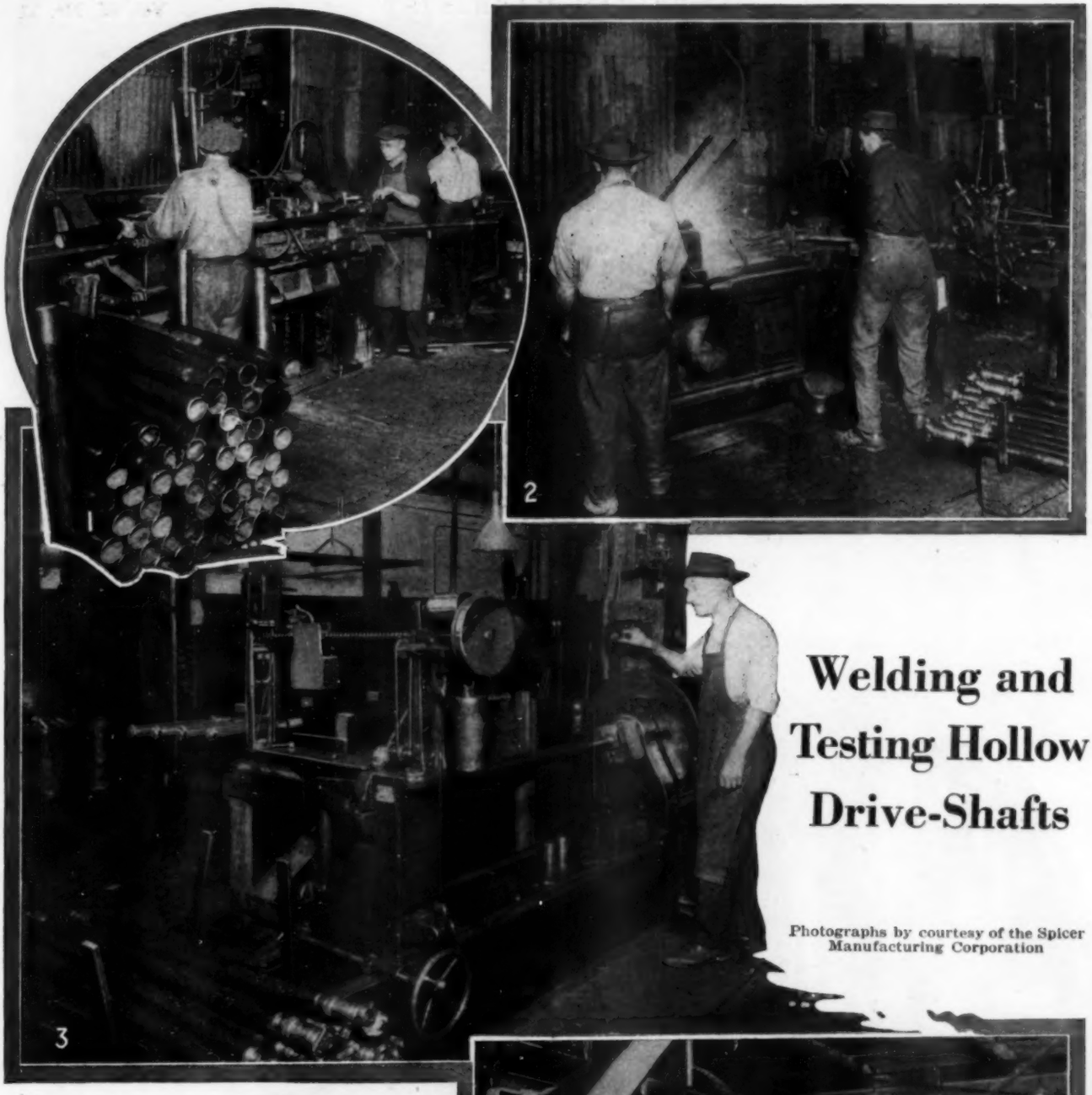
Two of the three largest suburban lines into Buenos Aires are fully electrified, and the third, the Southern Railway, plans to electrify its two main suburban lines and suburban loop. The power stations of the Central Argentine, and the Western railways are inter-connected, and will also be joined with that of the Southern when the latter is electrified. These three companies have 9,905 miles of main line railway.

The narrow-gage industrial railways of the Argentine Republic offer an exceptionally good opportunity as an open field for the sale of American mechanical equipment. One of these lines, however, the Agricultural Light Railways, of 75-cm. gage, is owned and operated by the Buenos Aires Southern Railway, while the La Forestal industrial railway, consisting of 257 miles of 1-meter, 75-cm., and 60-cm. gage lines, is owned by The Forestal Land and Timber Co., with home offices in London.

The Buenos Aires Southern Railway owns and operates commercial ports at Buenos Aires and at Bahia Blanca. It also operates a fleet of tugboats, lighters, dredges, and colliers. The latter are employed in bringing out coal from Wales for the use of the railroad. The Entre Rios and the North East Argentine Railways operate freight and passenger ferries over the Parana and Alta Parana rivers.

The Patagonian railroads are now entirely in the hands of the Argentine Government since the acquisition of the Central Chubut Railway from a British company in 1924. These Patagonian lines operate their locomotives with oil fuel from the government fields, and a system of supply trucks is maintained to supplement the government tanker service.

The development of aluminum alloys promises to change our ideas of structures of many kinds. A recent motor coach has been built that will seat 35 and carries 37 passengers standing. The structure is all of aluminum alloys and no chassis is employed. If we could use aluminum in machine construction it would greatly affect the strength needed and so reduce the cost of steel (or aluminum) for such purposes.



Welding and Testing Hollow Drive-Shafts

Photographs by courtesy of the Spicer Manufacturing Corporation

1—Machine for welding ends on drive-shaft tubes

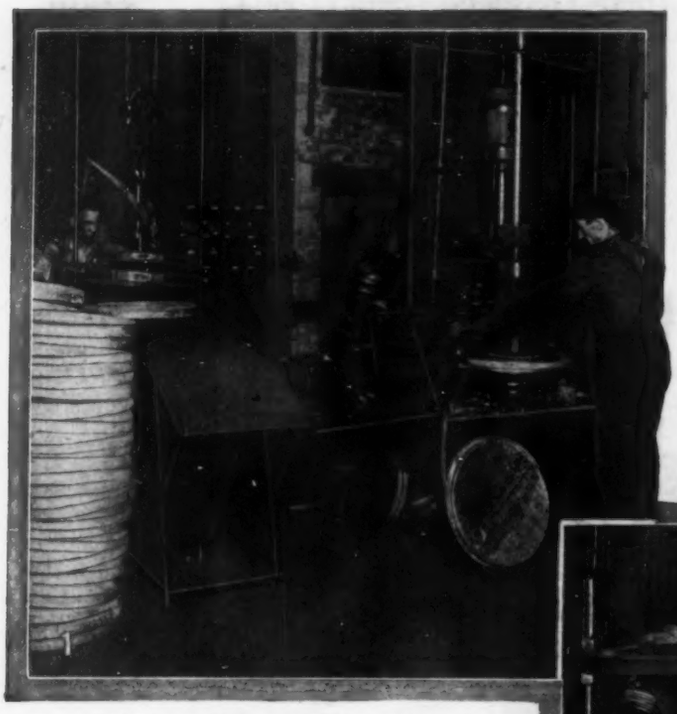
2—Welding yoke on end of drive tube

3—Torque-testing drive tubes far beyond working load

4—Stamping covers or casings for universal joints

Steel Drums in the Making

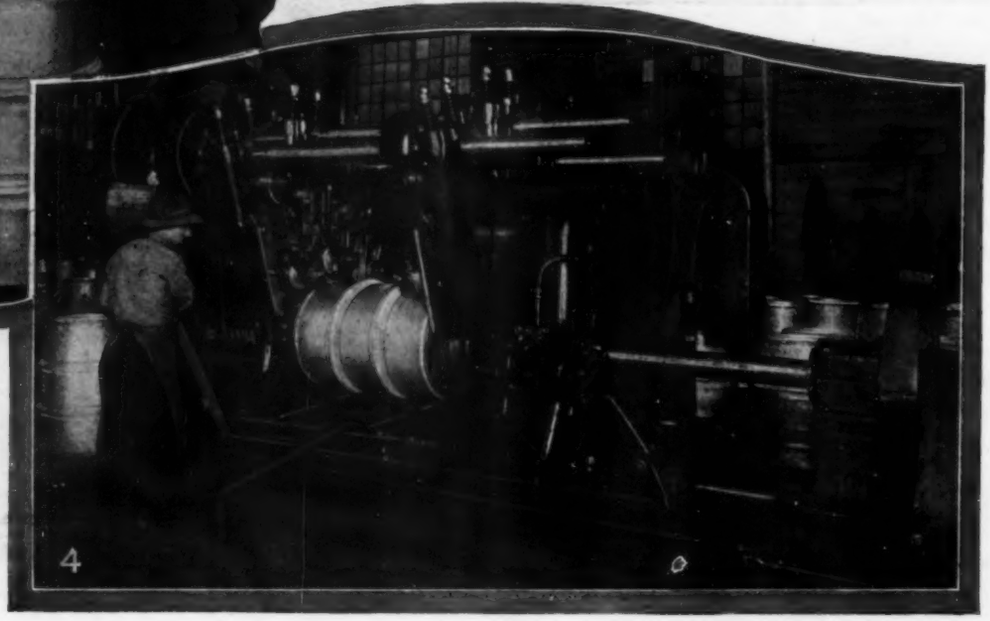
Photographs by courtesy of the Petroleum Iron Works, Sharon, Pa.



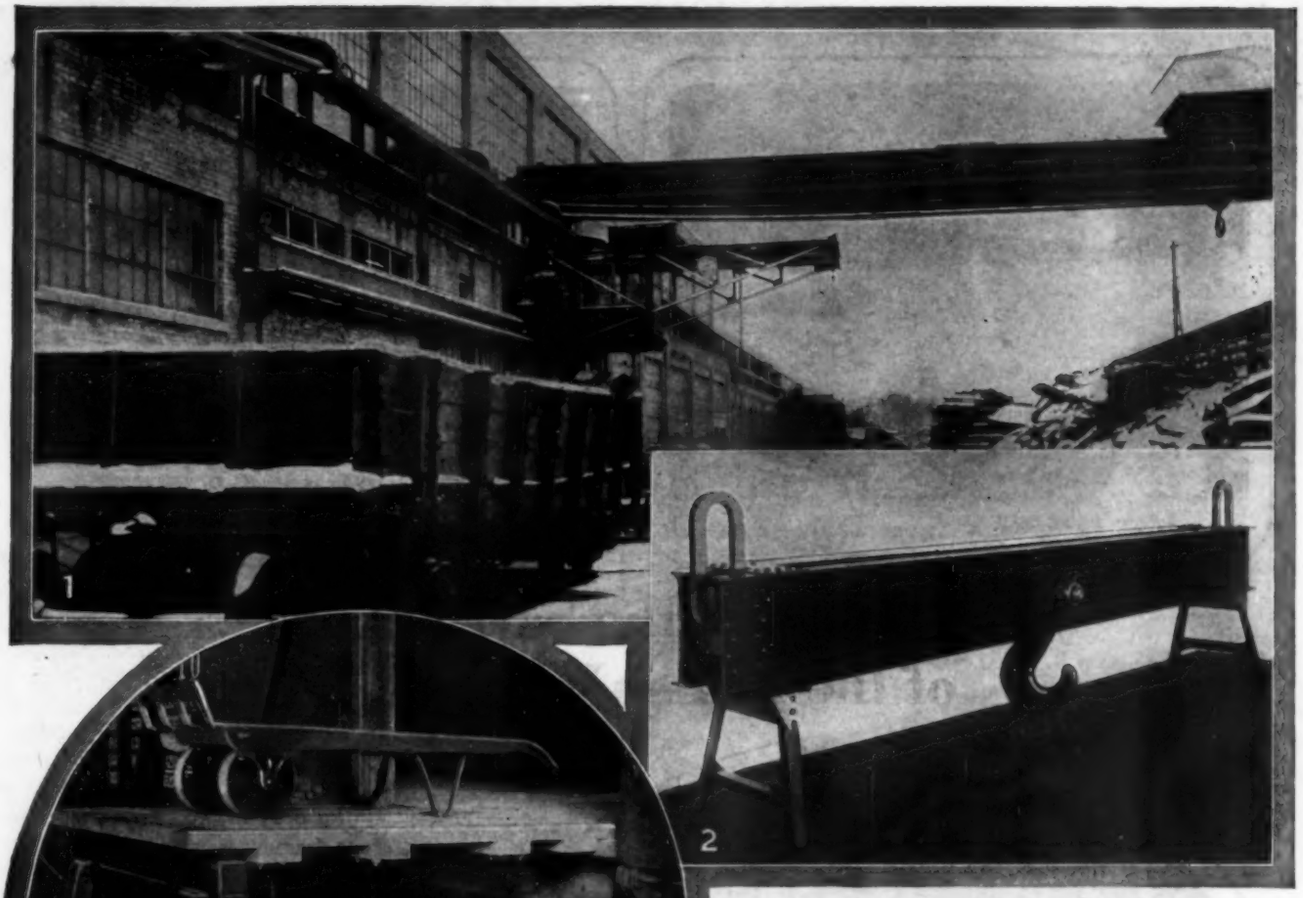
1—Putting reinforcing rings in heads

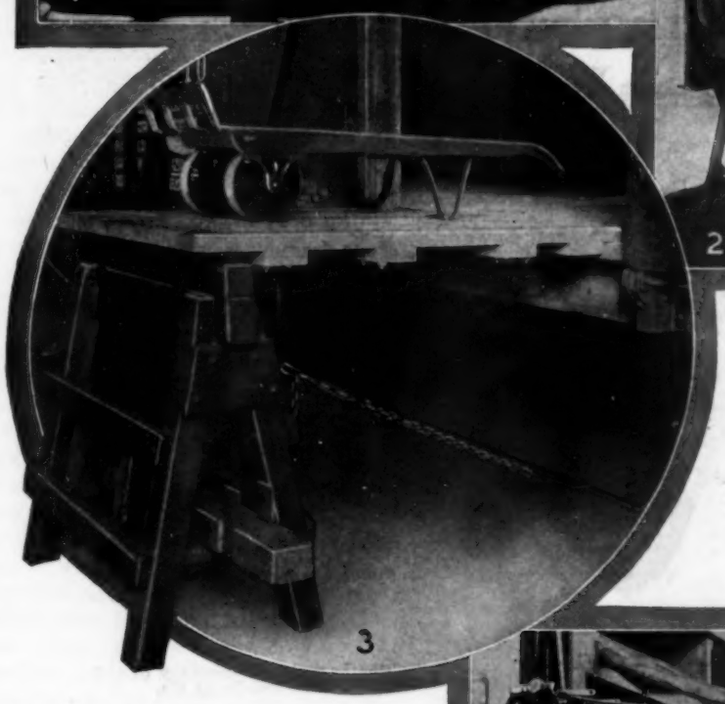
2—Pneumatic press forcing hoops into first position on drum

3—Forcing heads into position. If the body is slightly deformed the head fits smoothly



4—Machine that finishes the locking of tops and bottoms in place and forms the completed chine





Aids to Safety for Workmen

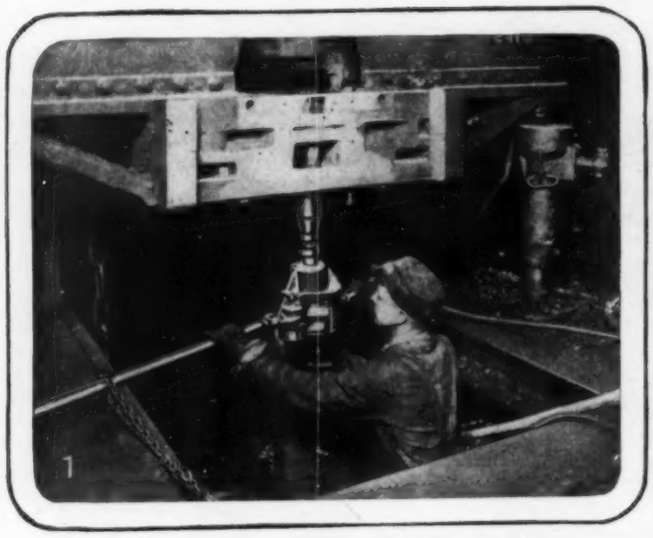
1—Passing one crane over the other. Lamp signals insure safety at night

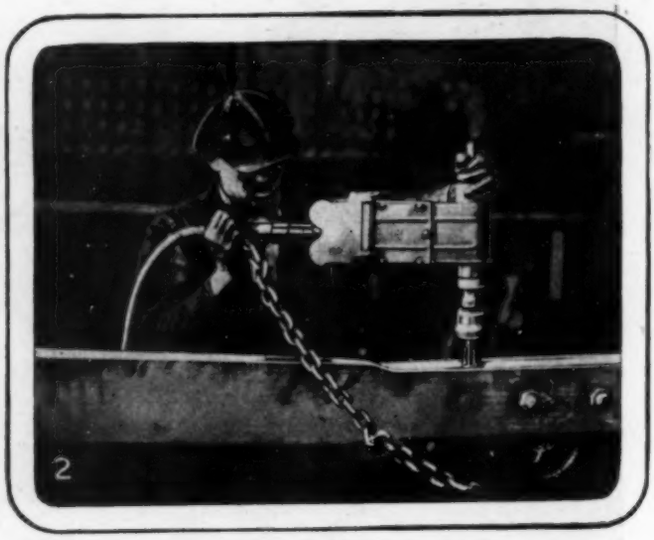
2—Equalizer beam to lift 60 tons with two 30-ton cranes. Legs keep beam off floor where it can be seen and prevent stumbling over it

3—Hooking trestle to rail to insure platform staying in place

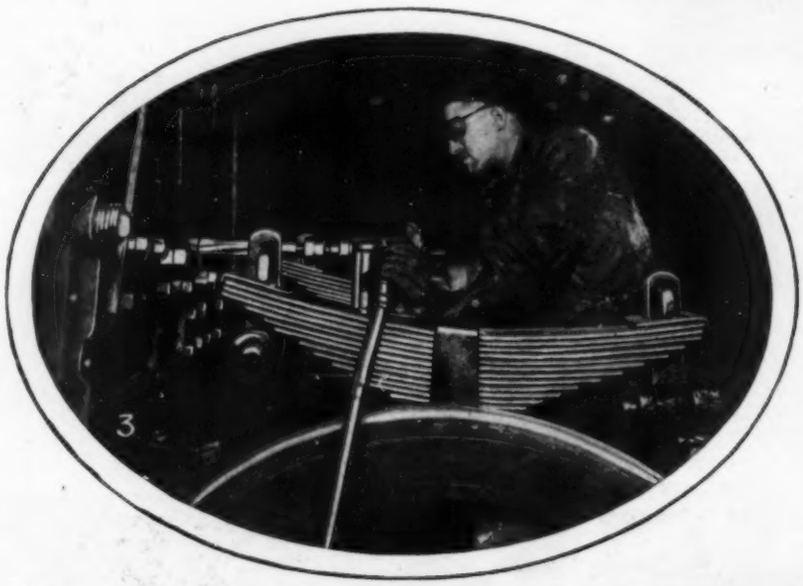
4—Support to keep air hose, light cables, etc., out of passageway

Illustrations 1 to 3 by courtesy of the Allis-Chalmers Manufacturing Co. Illustration 4 by courtesy of the General Electric Co.





Air Tools in the Sayre Shops of the Lehigh Valley R.R.



1—Drilling a 4½-in. hole in an engine cross-frame

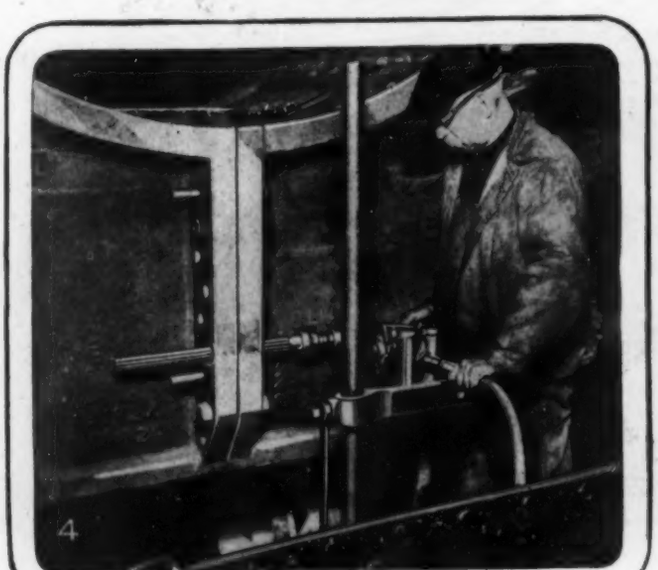
2—Reaming 1¼-in. holes in an engine frame

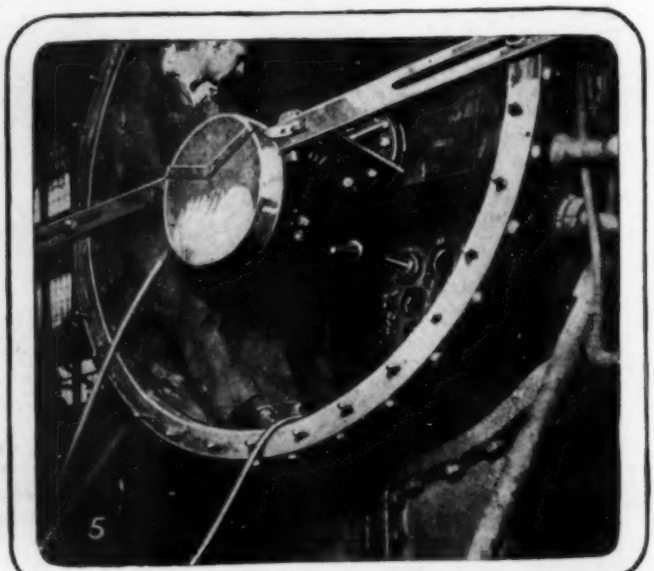
3—Reaming for splice bolts in guide-yoke sheet

4—Reaming holes in cylinder joint

5—Rolling 5½-in. superheater flues—special holder for air motor

Photographs by courtesy of the Ingersoll-Rand Co.





The District Apprenticeship System

By Harold S. Falk
Vice-President and Works Manager, The Falk Corporation

What happened when a large concern discontinued apprentice training—The trades must be given a new dignity—A national apprenticeship board

SOME time ago a group of visitors came to see us at Milwaukee. They were a committee representing the manufacturers of a medium-sized but well-known manufacturing city which produces machinery of various kinds. They had heard that the metal trades industry of Milwaukee was conducting a little experiment in district apprenticeship organization and desired to study the methods in use.

The spokesman of this group of men told the history of their apprenticeship work over the luncheon table and explained why they had come. In their city there is one large plant employing several thousand men and a large number of much smaller shops largely engaged in specialty work. The plant is an old institution, and, up to ten years ago, had been very active in training apprentices.. For many years this large plant had been producing mechanics not only for itself but for all the other shops in the city and district. Most of the apprentice graduates left this plant when their courses were completed to work in the other shops. However, enough remained to satisfy all requirements, and as long as the officers of the corporation were willing to train mechanics for the entire district, everyone was satisfied, especially the smaller corporations who were being supplied with skilled mechanics in whose training they had not the slightest part. The large corporation solved a labor problem that the small companies could not handle.

But ten years ago the large establishment was reorganized. New directors and new officers brought new ideas into the business and every department was gone over very thoroughly to determine where money could be saved. The new officials had been brought up in the financial rather than in the manufacturing field, and when they began their investigation of the apprentice department the apprentice supervisor was called in to justify his presence and work. They pointed out to him that his department was costing the corporation considerably over twenty thousand dollars per year. He admitted that the figure was about right. They asked him how many apprentices he had in the shop. He said about three hundred. They then asked what proportion of those who completed their time remained at work or returned after a year or so in other plants. He answered about a third, becoming very red in the face and uncomfortable.

"Do you mean to say that this corporation has been spending nearly twenty thousand dollars per year in training young men for every little shop in town?"

"I'm afraid that's what has been going on."

"That is a crime. Other plants of this size get along without apprentice training. Where do they get their mechanics?"

"Why, they go out and hire them wherever they can. If there are none available in the neighborhood, they import them."

"Well, that is what we shall do from now on. Do not hire any more apprentices."

A great change came gradually after a few years. A number of years passed and many skilled workmen had died and others had moved to other districts. There were none to take their places and a shortage gradually developed. The different shops began to bid against each other for the services of those mechanics who remained. After a few more years the rumor of higher wages in the city began to attract transient workers. When business was very good and there were not enough transients available, carloads of workmen were imported from wherever they could be obtained. Labor turnover more than doubled in all plants of the city, and manufacturing costs mounted higher and higher. With the transient workmen came agitators

> Apprentice training has been found to affect nearly every department in both industrial and municipal life and health. Experience in Milwaukee has taught the need of the district apprenticeship system on the part of every industrial town or city. To be efficient in its operation, however, the training of apprentices should be placed under the direction of a national board maintained in a way similar to the National Safety Council

Abstract of a paper presented at the New Haven Machine Tool Exhibition, Yale University, Sept. 7-10, 1926.

and other undesirables. Labor troubles developed here and there, something which had never been heard of in that city. Portions of the town became disreputable and crimes of various kinds became common. Things went from bad to worse and, while conditions may not have been more serious than in other industrial centers, they were bad enough to bring about a series of joint meetings between various civic organizations and the manufacturers of the city in order to devise some way of restoring the former healthy condition of the community with its orderly population of satisfied, highly skilled workmen.

After much discussion it was decided to re-establish apprenticeship and, as one speaker expressed it, "get our mechanics from our own schools and not from the blacklists of other towns." However, the officials of the big corporation refused to consider the re-establishment of any system, no matter how much it was needed, whereby the entire burden of training skilled men for the city would rest upon them. On the other hand, the small shops maintained that they could not possibly train apprentices because their work was too specialized to provide all-around trade training. It was agreed that both attitudes were reasonable, and a committee was appointed to investigate the possibility of some scheme of co-operative, district apprentice training.

It was this committee which came to Milwaukee.

A district apprenticeship program will very likely solve the problems of this industrial center. The burden of training mechanics can be properly distributed by an interchange of apprentices, justly administered by a central organization. The large shop and the smaller shops should all hire apprentices in the proportion of their employment of skilled mechanics and in such numbers as will insure sufficient new men in the district every year.

Organization Is Necessary

On the face of it, this appears to be a simple solution of the problem, but the work will need to be very thoroughly organized in order to overcome many difficulties which will arise. The plan will not work if one shop pays higher wages than another; neither will it work if apprentices from outside shops are not treated with the same consideration in every plant as those who are employed there; nor will it succeed if there is any jealousy over the graduates who may be claimed by various corporations in whose plants they may have worked at various times. The first requisite for overcoming these difficulties is a central committee for apprentice training that is capable, impartial, and respected.

The college-graduate apprentice will be paid more than the high-school-graduate apprentice, and the high-school-graduate more than the apprentice who has had only an eighth-grade education. Other matters will need to be determined by this committee. How much time shall the apprentice spend at school and what shall his compensation be? Shall this school work be done in the public schools, in trade schools, or vocational schools?

A district apprenticeship system is necessary in order to distribute equally the burden of apprentice training in a community, but it is still more necessary in order to impress the apprenticeship idea upon the population. Apprenticeship appears to be a phase of shop management, a matter of work schedules and transfer from one kind of work to another and of hiring—and sometimes firing—boys of school age. It is very much more a matter of contacts in the community. Parents and teachers, and pastors, employment agencies, and newspaper men must be told about apprenticeship as well as foremen, superintendents, and the boys themselves. Apprenticeship is not only a matter of training boys but of getting boys of the right caliber. Every one knows that the average American young man is not much disposed to go into industrial work, nor can it be expected under modern conditions. The trades must be given a new dignity.

The Milwaukee System

All this is not mere theory, it has been proven by actual experience. The metal-trades industries of Milwaukee have been engaged in a district apprenticeship program for a number of years and, while a mere beginning has been made, the results justify the most extravagant predictions for the continued and increasing success of apprenticeship training as a result of the district organization. There are forty-nine members of the Milwaukee Metal Trades Association and in twenty-nine of these plants apprentices are employed, although only eight shops employ more than twenty-five apprentices. There is an apprenticeship committee of the Milwaukee branch of the Metal Trades Association, and work and pay schedules have been established and are in force.

In achieving this result the Industrial Commission of Wisconsin, which administers the apprenticeship law of the state, and the Milwaukee Vocational School have been of invaluable assistance. The latter institution, with a weekly attendance of about fifteen thousand young people, has been the center of the apprenticeship movement and activity of the city.

From the organization of a number of district apprenticeship systems to the establishment of a national apprenticeship program is a natural step. Our American industries require a certain number of mechanics and other skilled men every year. Just as it is unfair for one or two shops to train all the mechanics for a district, so is it unfair for one or two or even ten industrial districts to produce all the expert men required by the entire nation. And just as a strong district committee is necessary to make apprenticeship successful in a community, so is a national apprenticeship governing body necessary for the establishment of apprenticeship throughout the nation.

At present there are many organizations which are interested and active in the apprentice movement and all are doing their share. The Chamber of Commerce of the United States has turned its attention to the problem of apprenticeship. This indicates that leaders in all lines appreciate the necessity of training young men for the various industries. But is there not some duplication of effort in all these many enterprises? The corporation which is interested in apprentice training finds itself receiving information from and contributing information and money to a great many different organizations, all of which are promoting apprenticeship. Why cannot these various organizations turn their apprentice work over to one central committee on apprenticeship, similar to the National Safety Council, which shall direct all apprentice work for all these organizations?

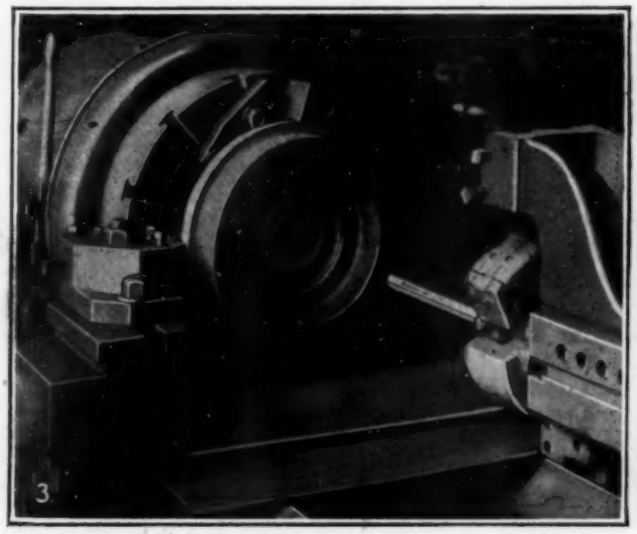
Automotive Production

Fig. 1—Bringing flywheels from the foundry. Fig. 2—Roughing on Mult-au-matic

How Production Methods Vary in Shops Building "Light Sixes"

By Fred H. Colvin
Editor, *American Machinist*

THE flywheels for both the Willys-Knight and Overland engines are made at the plant of the Wilson Foundry and Machine Co., Pontiac, Mich. The wheels are brought from the foundry by the inclined conveyor shown in Fig. 1, which transfers them to the short gravity conveyor on the left then delivers them to the Bullard Mult-au-matics and Gisholt machines, where the turning and boring operations are performed. One of the Mult-au-matics is shown in Fig. 2, the loading station being in front and the station



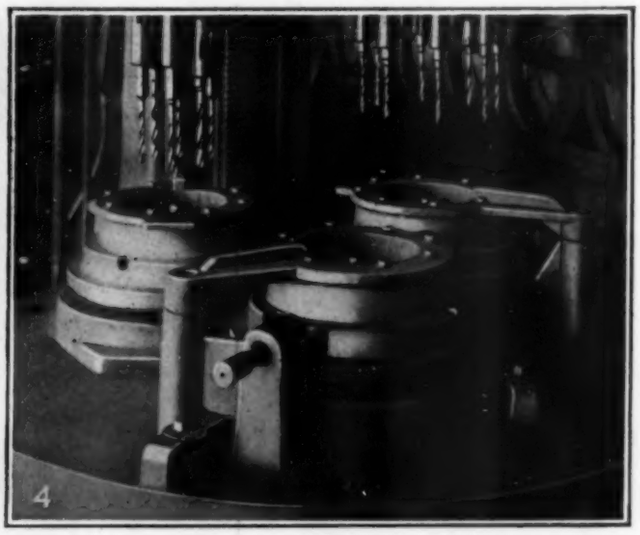


Fig. 3—Similar operation on Gisholt automatic. Fig. 4—Three-station multiple drilling

Automotive Production

for the first operation at the left. The station for the last operation is at the right.

The other method of handling the job is in the new Gisholt automatic turret lathe, Fig. 3. The work is put in a heavy, 3-jawed chuck and the various operations are performed without further attention from the operator. After an inspection, the wheels go to the drilling machine, Fig. 4, with its 3-station table carrying the fixture shown. The jig plate carries bushings for both the outer row of holes and for those in the inner part of the wheel. The two sets of drills are clearly shown, being arranged in groups in the head of a Natco multiple drilling machine. The use of two stations allows fourteen holes to be drilled at each movement of the drilling head.

Gear teeth for the starter are cut in the rims of the wheels in Fellows machines, some of which are of the new high-speed type, while others are of the older design. The new machine cuts one wheel at a time, while the older ones handle two wheels at once, but even then they lag behind the new ones in production.

The timing marks are stamped on the flywheels in the stand in Fig. 6. The wheel is located by the keyway in the center hole and the marks are put on by striking the plungers *A* and *B* with a hammer.

A final test is made in the gaging fixture, Fig. 7.

Fig. 5—Cutting teeth on gear shaper

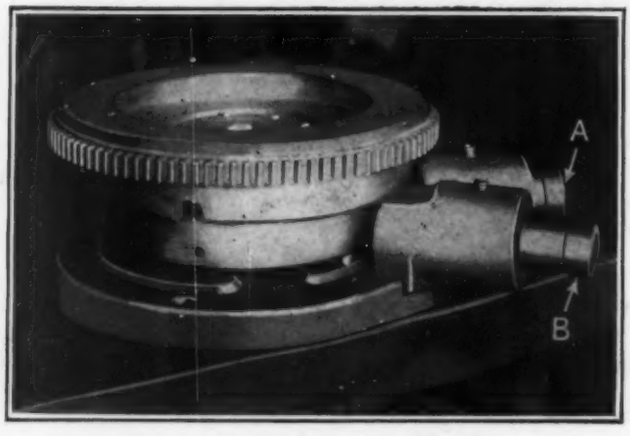


Fig. 6—Marking the timing points

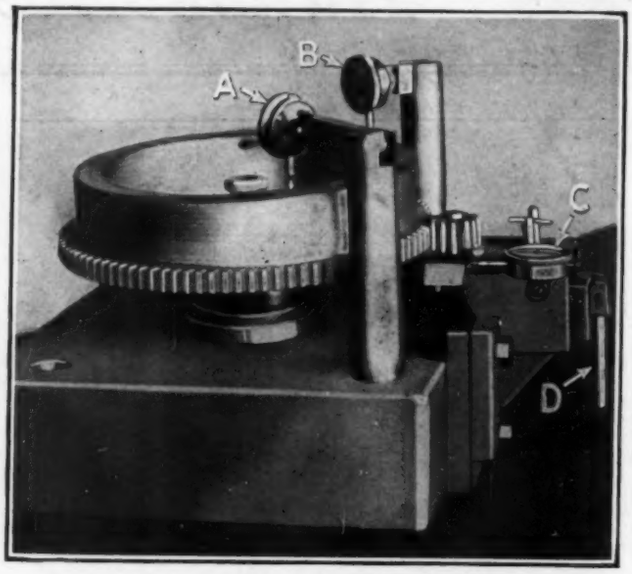


Fig. 7—Final inspection gage

This fixture not only tests the gears for eccentricity and wabble by means of dial indicators, *A* and *B*, but also tests the gear teeth as they mesh into the pinion shown. Revolving the gear moves the pinion in or out if the gear teeth are not concentric or if they are irregular. The amount of this movement is shown by the dial indicator at *C*. The pinion is kept in mesh by a spring and can be held out of mesh by the lever *D*.

The eighth article. The ninth will appear in an early issue.

Air Mail Development in United States

The air mail does its work so unostentatiously that few fully realize the extent to which it is being developed. All who have occasion to send mail matter a thousand miles or more should keep posted as to the points now reached by the improved service.

The new contract air mail service in operation covers many cities aside from the main trans-continental route. Those now reached include Boston, Miami, New Orleans, Dallas, Denver, Los Angeles, Boise, Seattle, Minneapolis and many other cities en route. Some of the new contract routes are nearly a thousand miles long; others are very short.

The Air Mail Division of the Post Office has issued a bulletin that contains schedules of all the routes. This is not only of great interest but its value as a time saver should give it a place in the office of every going concern having mail communication with distant points. It shows the time of both air and train mail and tells when, and how much, you can save by using the air mail service.

A well known, high-speed automobile engine uses 3 piston rings $\frac{1}{4}$ in. wide and with a gap of 0.004 to 0.006 in. between the ends. The piston has a clearance of 0.003 in. at the skirt and 0.015 in. at the head.

Gear Teeth in Action

By Earle Buckingham
Associate Professor of Engineering Standards and Measurements
Massachusetts Institute of Technology

Relation of noise to design of gear blanks, cases and carriers—The function of a lubricant on gear teeth—Selection of the proper lubricant to meet various conditions

THE shape of the gear blank itself often has a marked effect on the relative quietness of the gears. A blank that has the general properties of a bell will pick up and sustain a sound of its own vibration frequency that is created either by the engagement of the gear teeth or by some other outside agency, and will oftentimes amplify such sounds considerably. In many cases the introduction of ribs on such blanks will greatly reduce their resonance. Again, a gear made in two parts, such as a forged steel rim mounted on a cast-iron or a cast-steel core or one split in two sections will oftentimes operate more quietly than a solid gear, as vibrations are dampened or absorbed by a machined joint, either in the gears themselves or in their case or carrier. A gear made of built-up sections is often ideal from this point of view. Quietness of gear operation depends to a large extent upon the ability of the construction of both the gears and their carrier to dampen or absorb vibrations set up by the action of the gear teeth.

On the other hand, gears that are to operate at relatively high pitch-line velocities must usually be solid. Steel rims shrunk on cast cores are used to some extent, but continued operation tends to loosen the steel rims. The same tooth engagements that cause the sound also tend to peen out the gear ring and thus make it larger. When a rim is shrunk on a core for use as a gear that is to operate at high pitch-line velocities, it should be secured from turning by other means than a tight fit due to shrinkage.

In order to obtain the best results, gears must be rigidly mounted so as to hold the teeth in their proper relationship to each other when they are in operation. The shafts or studs that carry spur gears must be parallel. The exact center distance for involute gears is of secondary importance; the alignment is far more important. Gears should be carried as closely to a rigid support as possible and should not be mounted in the midde of a long flexible shaft insufficiently supported, nor on the end of a shaft that projects considerably from its bearing. Noisy gear conditions are not always due to improper gears. When the design of the mounting is at fault, even perfect gears perform unsatisfactorily.

Some sound is inevitable when power is transmitted through gear teeth. The volume of this sound may be small, yet the size and shape of the gear case may be such that much more sound will be heard outside of the case than originally started from the inside. One of the easiest things to accomplish is to make an effective loud speaker out of a gear case. Large flat surfaces, although the easiest to draw, should be avoided. When any great production of any particular unit is contemplated, such as a change gear box for an automobile transmission, it would be wise to experiment with the shape of the case, after the other features of design had been settled, in order to see what could be accomplished in muffling the sounds inside by changes in the shape. Such changes in the shape would affect both the volume and the quality of the sounds transmitted. As stated before, the ideal case would be one that would not respond to any tone.

> For quiet operation the exact center distance for involute gears is secondary to the alignment. Gears should be carried as closely to a rigid support as possible and not in the middle of a long flexible shaft. Noisy gears are not always due to improper gears. When the design of the mounting is at fault, even perfect gears perform unsatisfactorily

In addition to their own faults, gear teeth often reveal faults of other parts of the mechanism. Gear teeth form a loose connection that is very favorable to the transfer of vibration into sound. This sound, amplified by the gear case, often produces a result that is objectionable.

It is essential that gears in operation rotate about a fixed center. This means that they should be firmly attached to the shaft that they drive. With sliding gears, this result cannot be attained because in order to slide freely there must be sufficient looseness or play between the gears and shaft in order to prevent binding. In machine tool construction, sliding gears are usually mounted on shafts with one or two long keys or splines. In automobile construction, the shafts have several splines, the number usually ranging from six to twelve.

It is questionable whether a large number of splines has any beneficial result when used with sliding gears. It is not possible to attain a high enough degree of

The second article. The third will appear in an early issue.

accuracy in the machining of the splined holes and shafts to always secure an equal bearing on all the splines. As a result, only a few of them drive. The effect may be to force the gear off center in order to equalize the pressure on three of these splines. If two of them should be adjacent splines, there is a possibility that the gear will shift its position during rotation and thus introduce further variations in the tooth action with all the attendant noise. In many respects it would seem as though a three-spline shaft would be more logical for sliding gears. In this case the pressure against the splines would have a constant centering influence that should improve the operation of the gears. It is significant to note in this connection that the quietest transmission, of which the writer has any knowledge, employs a three-spline shaft for the sliding gears. This is another subject that would well repay a careful investigation.

Gears employed to drive parts of appreciable mass should not be rigidly attached to them but should have some degree of flexibility in the connection. This flexibility may be obtained by the use of a sufficiently long shaft or by means of a flexible coupling. This flexibility is desirable in order to prevent or to minimize both the effects of irregularities of the tooth action on the driven mass and the effects of variations in the load developed by the driven mass on the tooth action of the gears.

Flexible couplings are also used to compensate for any mis-alignment of the connected shafts. The primary purpose of a flexible coupling used on gear drives, however, is to absorb sudden shocks from whatever cause and to dampen out vibrations from both the gears and the driven mechanism.

Lubrication of Gears

*A certain amount of sliding takes place between the profiles of all gear tooth forms in operation. This sliding creates friction, which can be partially overcome by lubrication. If no lubricant is introduced between the sliding surfaces, the friction is what may be termed solid friction. If sufficient lubricant is always present so that the two surfaces never touch each other, the friction is what may be termed fluid friction. When lubricant is present between the sliding surfaces, but the pressure is so high that the film of lubricant breaks down, or for any other reason the sliding surfaces are not always separated by a film of lubricant, we have a condition of semi-lubricated surfaces.

All surfaces are more or less rough; even surfaces that are well machined and polished show under the microscope small projections and depressions. It is the interlocking of these minute projections that causes solid friction when two unlubricated surfaces are pressed together and move relative to one another. In general terms, the laws of solid friction are as follows:

The frictional resistance is

(a) directly proportional to the total pressure between the surfaces

(b) independent of the rubbing speed of the surfaces at low speeds, but decreases at very high speeds

(c) independent of the areas of the surfaces

(d) dependent to a considerable extent on the roughness and hardness of the surfaces.

These laws apply whether the motion is rolling or sliding. Owing to the surface irregularities, wear takes place, the softer material being more rapidly abraded than the harder. The wear and friction are much less for hard and smooth surfaces than for soft and rough surfaces. Surfaces of exactly the same materials are more inclined to seize and weld than dissimilar surfaces; hence the reason why materials of different hardness and composition should usually be used for all rubbing surfaces. Two exceptions to this rule are the cases of cast iron on cast iron and hardened steel on hardened steel. In both examples excellent results are obtained.

Although the friction between solid surfaces is independent of the area in contact, the wear is obviously the greater, the smaller the area, because of the greater unit pressure.

By the introduction of a suitable third medium between the frictional surfaces, the solid friction may be partially or wholly eliminated. This medium may be solid, such as graphite, talc, white-lead, and the like, semi-solid, such as grease, or of an oily nature, such as lubricating oil.

Film Formation

The object of all lubrication is that the lubricant should attach itself to the rubbing surfaces and form between them a film, which under the conditions of speed, pressure, and temperature prevailing will not be squeezed out, but will keep the frictional surfaces apart. This object is not often attained, except in high speed bearings.

In bearings thus perfectly lubricated, the "rubbing" surfaces never touch one another, and the friction is entirely dependent upon the lubricant. The laws governing fluid friction are totally different from the laws for solid friction, and may be summarized as follows:

The frictional resistance

(a) is independent of the pressure between the surfaces

(b) increases with the speed of the rubbing surfaces

(c) increases with the area of the rubbing surfaces

(d) is independent of the condition of the rubbing surfaces, or the material of which they are composed

(e) depends on the viscosity of the lubricant at the working temperature of the oil film.

The coefficient of friction for unlubricated surfaces ranges from 0.1 to 0.4, but with fluid friction the coefficient of friction ranges from 0.002 to 0.010 according to the viscosity of the oil. It is therefore well worth while to approach as closely as possible a condition of fluid friction because of both a saving in power and a reduction of wear.

Under conditions of low speed and high pressure it is impossible, or at best extremely difficult, to obtain perfect film formation. With the great majority of gear drives, where the tooth action tends to wipe off the lubricant, where the unit pressures are very high, and where, at high speed, the lubricant is thrown off the teeth by centrifugal action, it is not possible to produce anything approaching perfect film formation. The surfaces accordingly are in an imperfectly lubricated or semi-lubricated condition, for which the coefficient of friction will range from 0.01 to 0.10 according to whether the surfaces are fairly well lubricated, thus approaching the condition of perfectly lubricated surfaces, or very poorly lubricated, thus approaching the condition of unlubricated surfaces.

*Abstracted from "Practice of Lubrication"—Thompson.

There are no definite laws governing the friction of semi-lubricated surfaces. The frictional resistance is composed partly of solid friction and partly of fluid friction, and the more the solid friction predominates, the more important is the property known as oiliness, and the less important is the viscosity of the lubricant. The object of lubrication of such surfaces is to make the best possible compromise between reduction of wear and reduction of fluid friction. For conditions of low pressure and high speed, the reduction of fluid friction is usually the most important point to consider, and its attainment demands low viscosity oils of great oiliness; whereas for conditions of high pressure and low speed, the reduction of wear must be given prime consideration, and its attainment therefore calls for viscous oils of great oiliness.

Lubricants

Lubricants may be divided into three classes: first, lubricating oils; second, semi-solid lubricants; and third, solid lubricants. Semi-solid lubricants are those that do not flow at ordinary room temperatures. Solid lubricants are those composed of solid materials such as graphite, talc, soapstone, etc. Some solid lubricants may be so finely divided as to enable them to be suspended in colloidal form in a liquid carrier. An example is "Oildag," which is a diffusion of colloidal graphite and oil.

For efficient lubrication, oils must be selected to suit the operating conditions and the oiling system employed. In general terms, oils light in body should be employed for such conditions as high speeds, low pressures, low temperatures, and good mechanical conditions, while oils heavy in body should be employed for low speeds, high pressures, high temperatures, and bad or indifferent mechanical conditions.

All fixed oils (animal or vegetable) are more oily than mineral oils, and an admixture of a few per cent to the mineral oil will increase the latter's oiliness and assist in separating the rubbing surfaces more completely. If it were not for the high price of fixed oils and their tendency to gum (particularly the vegetable oils), they ought to be much more widely used than is the case at present.

Compounded oils also have the property of combining and emulsifying with water, so that their use is desirable where water may gain access to the gears. Water will displace a straight mineral oil and cause trouble, but will combine with a compounded oil and form an emulsion or lather.

Semi-solid or grease lubricants are advantageous in dusty and dirty surroundings, such as in cement mills, when the gears are not entirely inclosed. Grease should be used only where there are special reasons against the use of oil.

When a solid lubricant is introduced between otherwise unlubricated surfaces, the more or less finely divided particles of the lubricant associate themselves with one or other of the rubbing surfaces, filling in the pores and depressions. They act, as far as possible, as a smoothing and polishing agent, and cover the original surfaces with a thin smooth layer of the solid lubricant. As a result, the coefficient of friction is reduced, since the solid friction between the more or less rough original rubbing surfaces is replaced by the lesser solid friction between the smooth surfaces formed by the solid lubricant. When abrasion takes place, it occurs not so much between the original surfaces, which possess great cohesion, as between the particles of the solid lubricant, which have but little cohesion. If solid lubricants are employed, cutting and abrasion of the rubbing surfaces are therefore much less likely to occur.

There are a variety of conditions for which dry solid lubricants have proved advantageous, as for example, in such parts of machinery where the lubrication is apt to be neglected and which operate at low pressures and low speeds. When such surfaces are well coated with graphite, for example, and particularly if they are rubbed down to a dense glazed finish, they will work upon each other for a long time with comparative freedom and without cutting or wear taking place.

Solid lubricants are also used in combination with other lubricants. The object of their use is

(a) to reduce the solid friction

(b) to produce a smoothness of the rubbing surfaces that will assist in distributing the load evenly over all parts of the rubbing surfaces and thus allow a lower viscosity lubricant to be used and the fluid friction to be reduced

(c) to reduce the wear of the original surfaces and the risk of abrasion or cutting of the surfaces

(d) to reduce the consumption of lubricant.

When chains or gears are inclosed in an oil tight casing, the use of oil is preferable to grease; in this case the admixture of a small amount of finely pulverized graphite or colloidal graphite is often beneficial for the smooth operation of the gears.

Lubrication Systems

The simplest method of lubricating the teeth of gears is to have the gear run in a bath of oil. This procedure requires an oil tight case, and it is suitable for gears running at relatively low pitch-line velocities. As the speed of the gears increases, the excess oil carried around by the gear teeth is forced from between them at the time of meshing in a very short space of time, thus developing excess heat and also additional noise. This condition becomes more acute with increase of the faces of the gears as well as with increase of speed of the gears. Generally speaking, this method of lubrication should not be used when the pitch-line velocities of the gears exceed about 1,000 feet per minute.

At the higher speeds, lubrication of the gear teeth may be accomplished by directing small streams of oil on the teeth. In general, the higher the speed, the finer should be such streams of oil. Because of the heating that develops when an excess of oil is present, high-speed gears often suffer from too much lubrication rather than too little. As a matter of fact, a large amount of oil that reaches the gear is thrown off against the case, thus creating a spray so that very high speed gears run in a bath or fog of oil mist. In many cases this oil mist itself is sufficient to provide lubrication for the gear teeth. For gears whose pitch line velocities exceed 4,000 ft. per minute, effective lubrication of the teeth can usually be secured by directing a small stream of oil against the side of the gear blank.

For geared turbine drives, if a single oil system is used for both the turbine bearings and the gears, and if the oil gets mixed with water, the oil will suffer in the turbine system to some extent; but when this same oil, mixed with minute particles of water and dirt, gets to the gears and is subjected to many times the bearing pressure, it is sure to suffer very quickly indeed. The result will be wear of the gearing. For these reasons,

the oiling system for the gears should be made distinct and separate from the oiling system supplying the turbine bearings, quite apart from the question of whether the same oil or two different oils are used in the two systems. With separate oiling systems, the oil for the gears will remain dry and pure for a much longer time, and will thus have a much better chance of keeping the teeth of the gears in good condition and preventing wear.

For automobile transmissions, the gears are lubricated easiest by means of oil, which should be filled into the gear box to the proper level. If the oil level is too high, the oil will run out of the gear shaft bearings and excessive heat and noise will be developed. If the oil level is too low, the gears will not dip sufficiently to splash the oil to all parts requiring lubrication. It is obviously desirable to use as low a viscosity oil as possible, and the only reason why engine oil is not used is because the gear box is not sufficiently tight to permit the use of such an oil, so that in order to prevent excessive leakage a heavy viscosity oil is used or even a semi-solid lubricant, so-called transmission greases. Transmission grease may be more economical than oil, but it has the disadvantage of causing greater loss in power and it does not distribute itself effectively to all bearings, so that trouble is often experienced, particularly when there are ball or roller bearings in more or less inaccessible positions. About the only possible benefit that is secured in this location by the use of heavy oil or grease is its soft-pedal effect on the vibrations of the gear box and hence the noise of operation.

Repairing a Cast-Iron Gear—Discussion

By E. Andrews

IT WAS with much interest that I read the article by O. P. Williams, under the title given above and published on page 586, Vol. 63, of the *American Machinist*. Having had considerable experience in welding new teeth in new cast-iron gear wheels by the electric, thermit, and oxyacetylene methods, I should like to add a few further notes, taken from my experience, in discussion of this subject.

In many engineering establishments and power plants, one or other of the following repair methods were formerly adopted and are still practiced where modern welding methods are not employed.

1. Screwing steel studs in the rim of the wheel, similarly to the studs shown in the wheel rim in Fig. 1, and building up the tooth by welding.

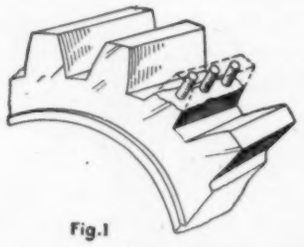
2. Brazing broken gear teeth, whereby a new piece of blank metal is accurately fitted into a dovetailed groove, filed or machined in the broken portion of the wheel. By this method, the teeth are first roughly sawed to form, and finally filed to the shape of the other teeth. A sheet-steel templet is usually made to the correct form of the gear teeth, then its shape is marked on the blank, care being taken to insure that the teeth are in pitch. When finished, the repair is brazed by using equal parts of calcined borax and boric acid as the brazing flux. The work is heated slowly to a cherry-red over a good, hard-coke fire, then fluxed and the brazing material applied. The heat is continued long enough only to cause the brazing metal to flow into place. After brazing, the work is allowed to cool slowly, otherwise the rapid chilling may be injurious to the casting.

3. Pinning or screwing on the broken piece as shown in Fig. 2 at *A*.

4. Inserting or embedding new tooth and screwing in as shown at *A* in Fig. 3. The character of the gear and the work performed by it have to be considered, and while in some cases the repaired teeth may last for years, in others they will only last a few hours or days. Steady, easy working will enable a repaired gear to last a long time, but if it is subjected to shocks caused by sudden changes of speed, or if the wheels working together do not function smoothly, the repaired teeth cannot last, although ordinary soldering may be used with some slight advantage in addition to the pinning or screwing methods.

Modern welding methods have shown that the welding in or building up gear teeth, give a homogeneous structure that may easily be machined and which possess a degree of strength equal to that of the original section. In cases where brass and bronze teeth have been welded in cast-iron gears, the teeth are stronger than the original cast-iron teeth.

I am most heartily in agreement with regard to the statement made by Mr. Williams that "cast iron is one of the easiest metals to weld successfully" by the oxyacetylene torch. To those familiar with oxyacetylene welding it is well known that there is a knack in making a strong weld in cast iron, that can be acquired only



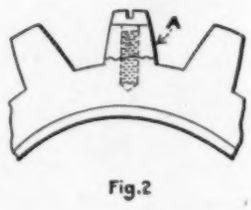
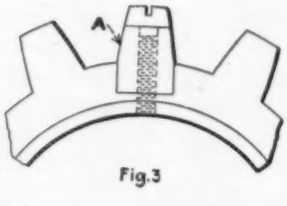


Fig. 1—Tooth built up around studs. Fig. 2—Broken tooth fastened by screws



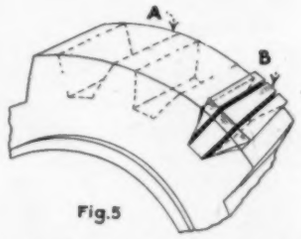


Fig. 3—New tooth imbedded in rim and fastened by screws. Fig. 5—Carbon block or plate method for building up new teeth

by exercise of considerable judgment and practice. In consequence, to those unacquainted with the process, the welding of cast iron appears to be more difficult of accomplishment than the oxyacetylene welding of wrought iron and mild steel, but such is not the case. As a matter of fact, cast iron, in the writer's opinion, is the easiest of these metals to weld.

A method of replacing a broken tooth in a 400-lb. gear from a large guillotine shearing machine, is shown in Fig. 1. The tooth having been completely broken

away, three ¼-in. equally-spaced holes were drilled in the rim, along a center line at the root of the tooth. These holes were then tapped ¼ in., and three studs of mild steel, ⅜ in. long, were made to suit the holes. The studs were fitted in position and the spaces were filled up by means of the electric arc, using a steel electrode. Afterwards the tooth was machined to the correct shape and size. A fairly good job was accomplished by the electric-welding process, but the method described was rather laborious and costly. Experience has shown that the oxyacetylene method of welding new teeth in a cast-iron gear is more economical than building in teeth by electric-welding methods.

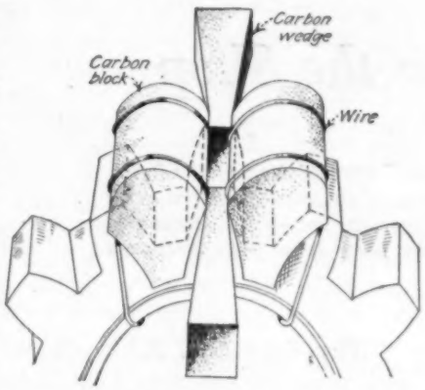


Fig. 4—Ready for welding in a new tooth by the oxyacetylene method

A good method of preparing to build up a broken gear tooth by welding with the oxyacetylene torch, is shown in Fig. 4. The carbon wedges hold the carbon blocks in position to form the sides of the new tooth.

The carbon blocks are made from carbons used in arc lamps. They are fitted on each side of the broken tooth, the space between the carbons giving the shape of the tooth required. To allow for the insertion of carbon wedges, the shaped pieces should overhang the gear-wheel rim at each side. The whole assembly is fastened by pieces of wire as shown. In building up the new tooth, the torch flame should play into the cavity between the carbons until the rim metal commences to fuse, keeping the welding rod well pushed down in the molten metal. The space should be filled slightly above the required finished height, so as to allow for filing or machining.

At *A* and *B*, Fig. 5, alternative methods are shown for repairing broken gear teeth, with and without carbon blocks or plates. In cases where the gear has cut teeth and a gear cutter of sufficient capacity is available, the better method is to weld in the broken teeth and adjoining tooth spaces solid with new metal, and then cut two spaces on the gear cutter. By this method a solid, well-formed tooth is invariably produced. If a gear cutter is not available, considerable hand finishing is required.

The carbon block or plate method (*B*, Fig. 5), is less expensive than filling up with solid metal, but it is not so likely to produce the best job.

Broken cast-iron gear teeth are oftentimes repaired by thermit welding methods. After cutting the teeth in a new gear, large blowholes were found which practically severed the ends of three teeth from the gear rim. The defective halves of the three teeth were chipped out and a solid block of metal cast in by the thermit process.

The teeth were then cut from the added metal. The gear was put into service, and the welded-in teeth lasted the whole life of the gear.

Whiskers and Experience

By Robert White

AN ENGINEERING friend of mine, now many years away from his Alma Mater, sports upon his chin a tuft of foliage that, whatever else may be its advantage or otherwise, certainly imparts to his benign countenance an expression indicative of mature years and the mental poise and judgment usually associated with them. When, one day, I took my courage in hand to ask him "how come" the spinach on his frontispiece he answered me thus:

"I was born and brought up in the engineering business, my father before me having been a successful engineer who had supervised many factory installations, and, as I was always more interested in machinery than in baseball and such childlike pursuits, I spent much time in and around the various jobs.

"One of the first real jobs that fell to my lot after I had joined forces professionally with my father, was to sell to an old-established and conservative firm, a complete heating and ventilating system for a large new plant which the firm had under contemplation. I was then in the very early twenties and not on speaking terms with failure.

"Appearing in due course before the full board of elderly and solemn directors, I displayed my carefully worked-out plans, explained the workings of the system, quoted prices and otherwise deported myself much as I imagined an older salesman would do. My system appeared to meet with the approval of the board, but there was an air if hesitancy that was finally given expression by their spokesman.

" 'My boy,' he said, in a kindly paternal manner, 'we like your system and we like the way you have explained it to us, but we would like to know who, in the event of its acceptance, would supervise the installation?'

"I would," I replied, promptly and confidently.

" 'That's just what we are afraid of,' said the spokesman. 'Though we can find no fault with your plans or with the way you have presented them, you must admit that your youthful appearance implies a lack of practical experience that might go far toward nullifying the value of the installation. I and my associates feel that the contract should go to an older and more seasoned man.'

"Arriving at my home office I was immediately sent out again, this time into the backwoods, to put in an installation of lesser importance than the one I had failed to land. I did not appear in civilization again for six weeks, and when upon my return I passed my own father on the sidewalk he gave me no sign of recognition.

"Correspondence with the western firm disclosing the fact that the contract had not been let, I again departed for their home city. Walking into the office with my chest thrown out and stroking my luxuriant beard, I expressed to the President our regret that my young and somewhat inexperienced brother had been sent to them upon the previous occasion; that, though he was a capable young fellow, we older heads could not but feel experience to be a factor of the utmost importance in work of the kind under consideration; and, if the board was still favorably disposed toward our system, I would undertake the installation myself.

"My proposition was promptly accepted. The system was installed without a hitch and it gave complete satisfaction to all concerned."

THE · FOREMAN'S · ROUND · TABLE

Teamwork in the Shop

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

THE Boss had been talking to the boys on co-operation but it hadn't sunk very deeply into Ed's cranium, for on the way home he said:

"There was a lot of bunk in the Old Man's talk on co-operation and teamwork this morning, Al. Sounds fine to tell you to work with the other fellow. But if you don't look out for 'number one' you're liable to get canned.

"Only last week," Ed went on, "Jones wanted to use one of my machines to help out his department. One of his machines went on the fritz and the assembly gang were hounding him for parts. But I had my own troubles and told him where to get off. I don't want 'em jumping on my neck too. I've got to keep a supply of parts ahead, you know."

"So it's you the boss was shooting at, was it, Ed? And you don't seem to realize you were the goat. Now see here, Ed, you better take a tumble to yourself and learn what teamwork really is. What do you suppose the Boss wants, a lot of parts piled up in your department, or a steady flow of finished machines out of the shipping-room door? And how can he have that unless Jones can get his parts out as fast as assembly wants 'em?

"Why, darn it all, Ed, can't you see that it was your refusing to help Jones out that balled up the whole works? Having a wad of your parts finished didn't help the output of the shop a bit. And the Boss was sure peeved about it. You better keep your thinker open the next time you have a chance to help out, or something is likely to drop.

"Don't think Jones is going to be the goat, Ed. Not when he has a good alibi that you wouldn't help him out. Of course, you must think about your own department first. But when you know assembly is going to be shy on parts from another department, just remember that any help you can give goes to your credit. Got to use sense, of course. Can't let your own work get behind while the other parts get ahead. But anything you can do to even out the flow is all to the good.

"Piling up parts in one department ties up money and doesn't help production at all. Making records at the expense of another department doesn't help to pay dividends, either, Ed. And don't forget that Jones isn't apt to be any too anxious to help you out if you get stuck the same way. That's a point to think over, too."

Did Al overstate the case of Ed's refusal to help out Jones?
How far should a foreman go in reducing his own output in cases like this?
How should Jones go about asking for help when a machine breaks down?
Was Ed justified in thinking only of his own output?

All foremen are urged to discuss these questions. Acceptable letters will be paid for. The discussion is not limited to foremen, of course

Discussion of Earlier Topics

Where Shall We Start Apprentices?

IN GENERAL the boys who are sent to the erecting floor first or to the repair department and there given a chance to learn, not used as mere chore boys, have always made the best men in the long run. The best mechanics in railroad shops are the men who started as boys in the round house and were then given erecting floor experience.

During the last railroad strike, boys were taken from the farm into the round house and in some cases into the back shop to finish up power on the erecting floor. Later some of these boys were taken on as apprentices. Instead of being given chore work, however, they were generally assigned to machines. It was found that these boys, with very little coaching, were able to do fully as good work as the machinists who had formerly held the places. It might be well to remember that some of our best mechanics today are men who started out as piece workers on one machine and then hired out in a different shop on another machine.

To get the best out of any apprentice one must give him work that will take all the powers of observation and inventiveness that he has to offer. Call for the best in a boy and he will usually respond. Give the boys the best that the shop affords. Change them as soon as they become proficient on one machine. Put some man in charge of them who knows tools and can do any work in the shop.—C. G. WILLIAMS.

Letting a Man Try His Own Way

THERE is surely something faulty about the kind of discipline which prevents a man with good ideas for the betterment of production methods from making them known.

I believe that this sort of authority Ed is trying to maintain, emphasizes the necessity of the foreman's rising above such views and remembering that he is still in a position to learn something from his men. He was not selected because he was the "knowingest" man in the shop but, more likely, because he was of the type who had the knack of getting along with men, of giving a helping hand where needed, and of being able to enlist their best efforts through a sympathetic understanding and appreciation of their importance as part of the production organization.

Men are keen to discern this smallness displayed by Ed, and once it is perceived he will not be overloaded with helpful suggestions or co-operation above the necessary amount. Of course, all men are not born salesmen and are not always able to sell their ideas with enough tact to prevent their manner of presentation from being offensive. But the foreman who is big enough can prove it by being able to make use of these often-times valuable ideas and never lose an iota of his prestige or hold on his job.—F. F. DICKSON.

Letting a Man Try His Own Way

EXPERIENCE has shown that it is not wise to allow any material change in methods on the spur of the moment. I believe I would strike a medium between Al's and Ed's views. A new idea will not always be a success and it must be viewed from all angles. Many times the workman is not in a position to do this.

Jimmie, no doubt, is a good man and if allowed to choose his method for doing the work, would show a great interest in doing the jobs assigned to him. But is Jimmie's method well laid out so that any man in his class can go on with it without delay?

Free rein can usually be given to workmen's ideas as to jobs. Guided by the following rules there would be very little loss to the foreman in production time and failure in new methods:

(1). If a job is set up and going through on an old schedule, complete it according to instructions.

(2). Make all suggestions complete in writing. Give the approximate saving in time and the cost of changing the method, tools and fixtures.

(3). Refer the changes to the foreman as soon as possible so that they can be made in time for the next run of the job.

The workman who is given the opportunity to do a little engineering with the aid of his foreman will appreciate the help of his foreman, since he will be gaining in his knowledge by expressing his views in a concrete form.—L. H. GAREY, *Foreman.*

Where Shall We Start Apprentices?

TRAINING a boy for his future, be it a machinist or any other trade, is really an extension of school. The school teacher in most cases cannot make a child understand everything. It is the parents together with the teacher, who complete the job.

The very same thing stands good for the apprentice. Without the help of the parents, the foreman has a hard job to complete his task. I have had quite a number of boys but very seldom have any of the parents taken very much interest in the boy's welfare. At least they never asked about the boy and his progress.

The main question is what part of the machinist

THE · NEXT · TOPIC

Who Should Boss the Move Men?

QUESTIONS

Should each foreman have an extra helper to act as move man?

Or is it better to have all transportation under the direction of a separate foreman?

Is the department foreman going to suffer loss of "dignity" or "prestige" by having this function exercised by someone else?

THE · FOREMAN'S · ROUND · TABLE

trade is the boy to learn. In four years' time, a boy will, in my opinion, be able to call himself a good all-around man but it is a long time before he can be considered as expert on everything.

A boy should take up practical and theoretical training at the same time by going to a good trade school. I always start a boy on a bench, teaching him how to use the file. After that I make him assemble small parts. This gives him an idea of fitting together. Then comes, in my opinion, the lathe as the most important machine. One year on a lathe in the beginning, before going back on the bench for another three months should be sufficient. If the boy has a chance, he should have the next six months of training in the drafting room. This will benefit him a great deal. After that a few months' experience on all the important machines in the shop and the rest on the bench should give the boy his foundation as a machinist.—G. KIRCHEIS, *Foreman.*

Letting a Man Try His Own Way

FOREMAN ED should by all means let Jimmie use his head as well as his hands. When a foreman takes an egotistic attitude and thinks that his is the only good way, he soon becomes undesirable as a department head. Al has the unselfish attitude, being willing to learn and at the same time to let the company get the benefit of more than one man's experience. No foreman can know it all, but he can be a fair judge when choosing between his own way and that of the workman.

A good foreman does not worry much about giving free rein to his workmen. He builds up a combination of loyalty and respect that is not in the least injured by letting a workman try his own methods on a job. In cases where reasonable discipline is being sacrificed, it would be wise to lose a few suggestions rather than have a demoralized department. In the majority of cases, however, a man with a different method merely wishes to have his way recognized as the better one. Allowing him to do a job his own way will rarely have any bearing on his conduct in the department or respect for his foreman.—LAWRENCE F. SWENSON.

Letting a Man Try His Own Way

THERE is something wrong with a foreman or with anyone in authority if he can't give his men some leeway both as to methods and behavior and yet maintain discipline and respect. I've seen some foremen who tried to put themselves on a pedestal and to adopt a "holier than thou" attitude who couldn't control their men at all. I've seen some foremen who treated their men as though they were on equal terms and who never had any difficulty in exacting obedience and in maintaining discipline.

Two men will scarcely ever do their best under the same treatment. Give one man a little freedom and he tries to take liberties. Do the same thing with his neighbor and you can almost see the satisfaction radiating from him at the thought that the boss has confidence in his judgment.

A lot depends on the kind of shop. When there are hundreds or thousands gathered together under one roof, building quantities of a more or less standardized product such as an automobile, it is practically necessary to have every man's actions and movements thought out and carefully delineated. But those very same instructions and methods are not the result of one man's ideas. They are the ideas of a number.

In the small shop with many different jobs, it is no criterion as to which is the better method because I happen to be Jimmie's boss. Many foremen get their jobs not because they can make a part better than anyone else in the shop but because the superintendent thinks that they can keep the men going and can see that everybody has a job with the proper material at the proper time, because they can think about more than one thing at a time.

I wish that I had a good many men like Jimmie. I would let him do it his way just as soon as he could show me that his method was better than mine. But if he couldn't convince me, I should insist on his doing it my way and see that he did it that way, too. Perhaps, he will occasionally get the idea that he is always right, but if the foreman is the right kind of a boss, it won't take long for him to find that he can go so far and no further. When he sees that the foreman is willing to recognize the merits of his suggestions, and to give them a try, there will be no trouble about discipline and the foreman will have Jimmie's respect.—GRANDON D. GATES.

Letting a Man Try His Own Way

IF THE foreman insists on having every job done in his way regardless of any suggestions from the workmen, they will soon not only cease to offer suggestions but will lose any desire to co-operate with their foreman. All men are responsive to some extent at least to the treatment they receive.

It is a great asset to the foreman and likewise to the firm to have a feeling among the workmen that they are free to suggest any plan that may be for the betterment of work or conditions and that their suggestions will be considered fairly and without prejudice.

A suggestion offered in good faith should always receive careful consideration and if it is not deemed practical, the one making the suggestion is justly entitled to a thorough explanation as to the reasons why it is not thought best to make use of it.

I cannot see that a foreman loses the respect of the workman by accepting their worth-while suggestions. In other words his standing with the workmen is very much dependent on his ability to pick out the valuable ones and to properly classify all of the suggestions offered.

Both good discipline and improved methods should prevail in a shop. The lack of either is a serious hindrance, and there is no good reason why one should

THE · FOREMAN'S · ROUND · TABLE

hinder the other. The foreman who will accept no suggestions is in a very insecure position due to the fact that there will be a lack of co-operation in his department that tends to lower the standard both in amount and quality and he as the responsible head must bear the consequences.—JOHN MARK MAY.

Picking Assistants

IN PICKING assistants Ed should choose one of his gang bosses if possible and fill the position from among the men. By doing this he provides an incentive both to the gang bosses and the men. At any cost he should not go outside for it is only in rare cases that a capable assistant cannot be chosen from among the men.

Records are a valuable assistance in such a case, especially records of attendance and punctuality. The fact that a man has made a mistake should not be held too strongly against him, for we all make mistakes.

It is a wise foreman who has men capable of running things while he is about as this shows his ability as a leader. Ed is not justified in being afraid to pick an assistant. In up-to-date plants the men capable of picking out and training assistants to fill their shoes move up not out.—THOMAS M. GARRY, *Foreman.*

Picking Assistants

AL IS wise in having men in his department who can keep things running while he is away. Unexpected absences, due to illness or other causes, should not be allowed to cripple the work of the shop which should go on in the absence of the foreman. Having another man capable of running Al's job temporarily will not make Al's job any less secure if the "boss" is broad-minded. In fact he will be pleased with Al's foresight in having a man trained for such an emergency.

Ed should pick an assistant with a view to the man's general character, honesty, length of employment, ability to get along with men and knowledge of the work. He should have in mind the man's complete record since entering the shop and not let a single mistake, sticking in his memory, prevent him from selecting a man who is otherwise capable and logically in line for the sub-foremanship. One mistake is apt to linger in the memory when a hundred jobs well done are forgotten.

—V. E. ATWELL.

Letting a Man Try His Own Way

AL AND ED represent two different kinds of foremen. Al would be the most profitable man to employ to take charge of either a toolroom or contract shop. He has an open mind which believes in utilizing the combined abilities of the men under his direct charge, in order to secure the most economical production of the work. Ed would be the foreman most suitable for a production department where jigs and tools are used and all work is supposed to be done according to certain prescribed methods.

Just because a man happens to be a foreman it need not be assumed that he is the one man who knows all there is to know about the business. No workman likes to feel as though he is working for a boss and the wise foreman should endeavor to keep the boss idea under cover as much as possible. He should make the men feel that he is there to help them to get the work done and that the more they co-operate with each other, the better the results will be when it comes to making money for the company.

Both the foreman and the workmen should always bear in mind that the company for which they are working is in competition with other companies and that the one whose policy is co-operation will be the one that will survive.—CHAS. HOMEWOOD.

Picking Assistants

FROM my experience I have learned that a good foreman has his department so well organized that a short period of absence is not immediately felt. I firmly believe that this is one good test of a foreman's ability. He also performs the duties which are assigned to him without complaint.

The foreman is never ready for the position above him until he has outgrown the one he now holds. He must be alert every moment and ready to analyze any suggestion that may come before him. Ed would not even be doing justice to himself in failing to pick an assistant. If the boss did have an idea that Ed was not the man for the job, Ed's fear of appointing an assistant would convince him that Ed was not big enough to be a real leader. Forgetting discords and thinking out new and better methods will hold the job.—ALFRED BRIESE, *Superintendent.*

Letting a Man Try His Own Way

A REAL mechanic can frequently improve upon his foreman's ideas as to how a given piece of work should be done. These methods are frequently thought up on the spur of the moment and as the mechanic works on the job he may be able to improve upon them. It is to the mechanic's advantage, in view of the possibility of higher wages and advancement, to make suggestions to his foreman, if he has a better plan for doing the work. It is, likewise, to the advantage of Ed, the foreman, to use these suggestions if he considers them better than his own methods.

If he does not adopt the suggestions, Ed should tell Jimmie his reasons for not doing so and, at the same time, let him know that his suggestions are appreciated even though not usable in this instance. Then the matter should be dropped. However, if Jimmie is of the type who still demurs, and if this job and every other job which Ed lays before him requires constant bickering to get the work done as Ed desires it to be done, then the foreman should certainly exercise his prerogative and either let Jimmie go or demand that he accede to his wishes.—A. M. MORRIS.

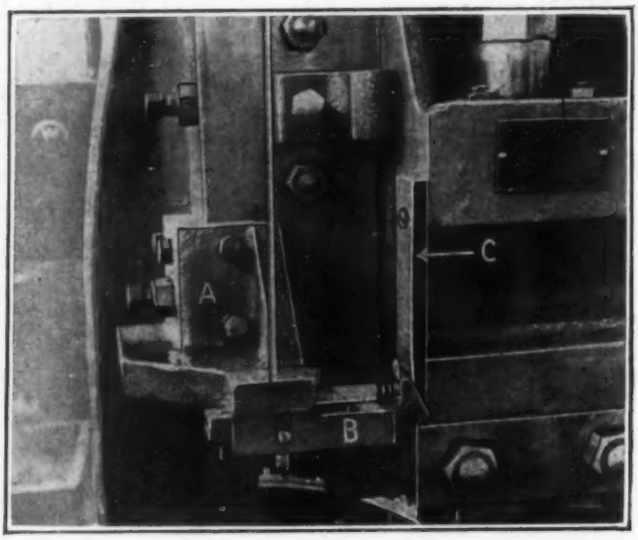
Ideas from Practical Men

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

A Wire-Cutting Device on a Press

BY HENRY DENSMORE

The cores for the rotor and field magnets of many small motors made by the Westinghouse Electric & Manufacturing Company at its East Springfield plant are riveted together by a press operation. The rivets with which they are joined are cut from wires, or rods, of soft iron by a device permanently attached to the



A wire-cutting device on a press

frame of the press in which the riveting is done. The cutting device requires no attention from the operator beyond putting in a wire or two occasionally, and it automatically keeps him supplied with rivets.

The stationary bracket *A*, bolted to the frame of the press, carries a slide *B*, gibbed to it in such manner that the slide may move freely in a direction parallel to the press shaft. A cam plate, *C*, having its lower end beveled to a suitable angle, is fastened by screws to the press ram in position to contact with the correspondingly beveled end of the slide as the ram descends, and causes the slide to be moved endwise.

Hardened steel bushings placed in holes drilled and reamed through both bracket and slide, act as shearing dies. Two or more such pairs of bushings are fitted to the device, so that a corresponding number of wires may be cut off at each movement of the slide.

Fastened to the frame of the press in vertical position above the device is a length of ordinary pipe to act as a holder and guide for the lengths of wire that are to be cut up into rivets. The lower ends of the wires pass through the bores of the respective bushings and rest upon an adjustable stop below the slide. The setting of the stop determines the length of the rivets to be cut.

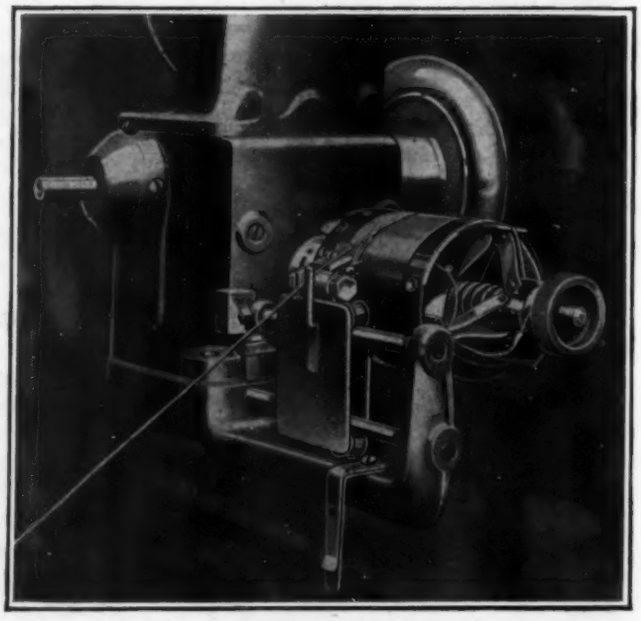
Each time the press ram comes down, the slide of the cutting device is pushed to the left by the cam *C*, offsetting the bores of the bushings far enough to cut off the wires and allow the severed ends to fall into a box placed on the bed of the press. As the ram rises, the slide is returned to its former position by a coil spring, allowing the long wires above to drop by gravity until their ends again rest upon the stop below the slide.

Winding Coils Neatly

BY OLIVER FRANKLIN

The illustration shows a device for winding coils that was made at the Stromberg-Carlson Telephone Manufacturing Co. The coils are for use in a Neutrodyne radio set, and great care is taken to make the three coils of the set as nearly mechanically and electrically alike as possible.

The tube is Formica and is purchased cut to the proper length. Holes for the connecters are drilled with a high-speed sensitive drill by the aid of a cylindrical jig. Then a thread is turned on the tube in order to obtain a neatly wound coil of a fixed number of turns. The coil is wound on the device illustrated. The tube is put over the expanding arbor and tightened



Device for winding coils neatly

in place by turning the knurled hand screw against spring pressure. The arbor is driven at moderate speed by an electric motor through worm gearing. The wire is guided by means of a V-notch in a carriage sliding along two horizontal rods. Rollers are provided to insure ease of movement. The movement of the carriage is actuated by a pivoted needle engaging the thread turned in the Formica tube. The needle follows the thread just as in the case of a cylindrical phonograph or Dictaphone record and needle.

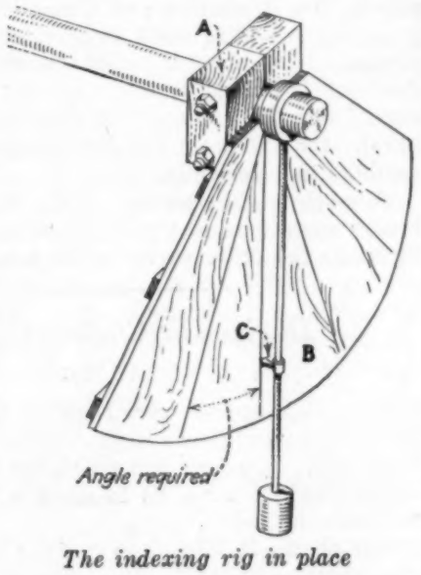
The reel from which the wire is wound is braked in order to produce sufficient tension to keep the wire taut as it is being wound on the tube. A trip automatically stops the machine when the carriage reaches a predetermined point.

An Improvised Indexing Rig

BY M. A. SCHMIDT

Some time ago we had the job of milling some keyseats in a shaft, the keyseats to be spaced around the shaft a certain number of degrees apart. Had there been many shafts to keyseat it would have paid to have made an indexing fixture, but since there was only one shaft, we had to rig up something simple and cheap. The illustration shows the device we made.

A couple of blocks of wood were sawed out to make the V-blocks *A* to be clamped on the shaft. Some box board was cleated together and sawed into a circular segment as at *B*. One side of the segment was covered with detail paper upon which the proper angles were drawn, using a protractor. The segment was sawed at the corner to fit the shaft and was then nailed to one of the V-blocks. With the shaft mounted on the milling machine table, the segment was clamped to its overhanging end by the V-blocks.



The indexing rig in place

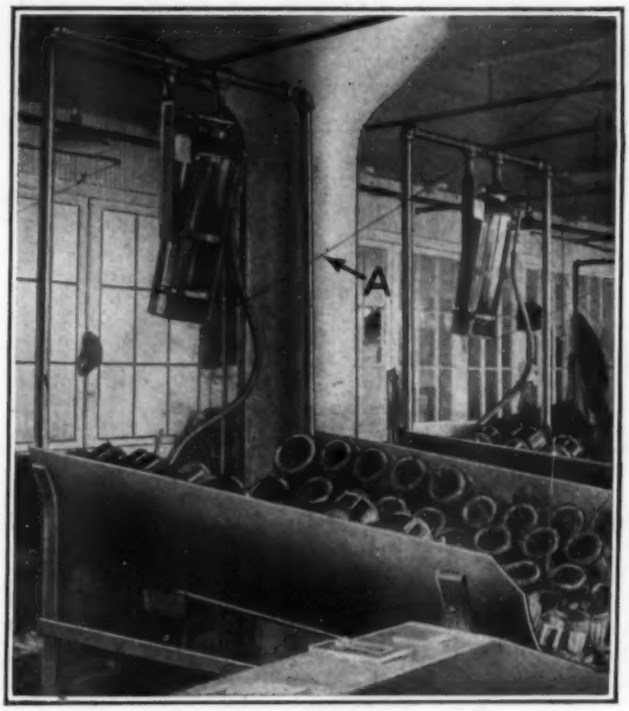
A collar, loose enough to turn freely on the shaft, had a rod screwed into the hole originally tapped for a setscrew. A piece of band iron clamped to the rod, as at *C*, served as a pointer, and a weight hung at the outer end acted as a plumb bob. The collar, with its fittings attached, was slipped on the end of the shaft, and the pointer was bent so it just cleared the paper on the segment.

After the first keyseat had been milled, the segment was adjusted to bring the first line on the paper to coincide with the pointer, and then clamped. In positioning the shaft for the next keyseat, the shaft was unclamped and turned (carrying the segment with it) until the next line was brought to the pointer, and so on until all the keyseats were finished.

Automatically Operated Fire Extinguishers

BY I. B. RICH

The fire hazard must always be considered in enameling departments or varnishing rooms, even though fires occur but seldom. In order to reduce this hazard to a minimum. The Robbins & Myers Co., Springfield, Ohio,



Automatic fire extinguisher release

has introduced a novel device for automatically extinguishing fires at the very outset.

The illustration shows the draining shelves or troughs on which the armatures and other parts of fan motors are placed after being dipped. At one end of each trough a framework is erected that supports a large fire extinguisher of the turn-over type, as shown. The hose outlet is carried down to a distributing pipe at the bottom of the trough.

It will be noted that the extinguishers are pivoted below the center of gravity and are so inclined that they will automatically turn upside down when the wire *A* is released. This wire is fastened to the extinguisher with a fusible link so that, should a fire occur, the link melts and the extinguisher turns upside down, mixing the acid with the alkali solution and setting up a pressure that forces out the liquid.

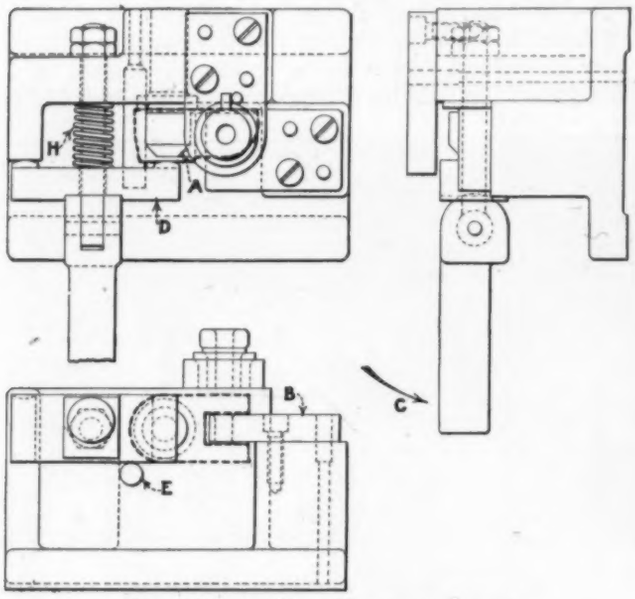
Jig With Double-Acting Cam Lever

BY L. L. LOCKE

While a cam-operated clamp is not new, the design illustrated forms a double purpose, that of locking the work, and rotating the clamp to permit removal of the work. It saves the time generally required to perform the latter operation, which often causes an operator to wish he had three hands.

The jig is used for drilling and reaming a ½-in. hole in hub of a rack bar for a washing machine. The

work is located on the plug *A*, the slot engaging with the plate *B*. When the cam lever is moved in the direction indicated at *C*, the work is held in place by the clamp *D*. The face of the clamp on which the cam



Jig with double-acting cam lever

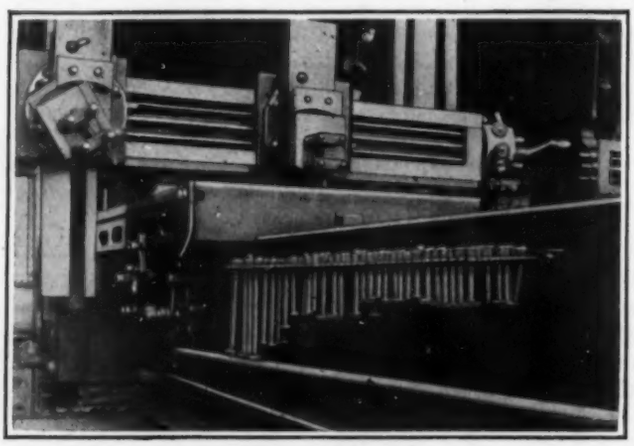
strikes is undercut and when the clamping pressure is released and the cam turned, the clamp turns with it. When the clamping pressure is released, the spring *H* raises the clamp, allowing it to clear the work and to permit it to be rotated. The pin *E* prevents the clamp from being turned too far when it is swung to the clamping position.

Keeping Planer Bolts in Place

By Henry C. Francis

A planer bolt is one of the things that you want when you want it. Hunting through a box of junk to find a bolt you can use, wastes a lot of time. So the Warner Elevator Co., Cincinnati, Ohio, has adopted a very simple and convenient bolt rack that fastens to the side of the planer bed, as shown.

The rack consists of a bar of flat steel about $\frac{1}{2}$x1$\frac{1}{2}$ in. with round pins driven in at convenient intervals. The pins are about $\frac{3}{4}$x5 in. and hold several bolts in each space. This simple arrangement keeps the bolts off the floor and out of boxes. It also makes it easy for the operator to pick the bolt he wants, and saves time.



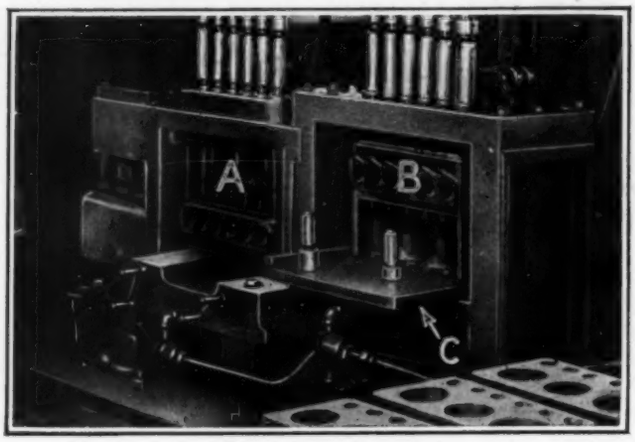
Planer bolt-rack

A Double Operation Set-Up

By William F. Sandmann

The illustration shows a set-up and fixture for drilling and reaming valve-guide holes and facing valve seats in cylinder blocks.

The fixture holds two blocks, one for the drilling and reaming at *A*, and the other for the valve-seat operation at *B*. A finished block is removed from *B* after each



Set-up for two operations

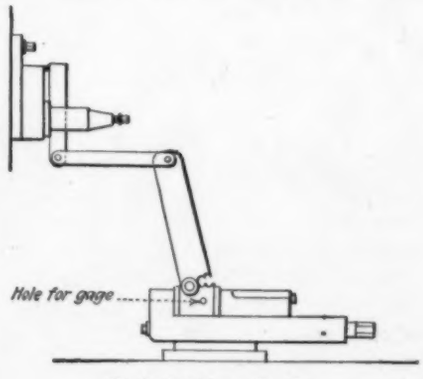
operation and the block that has been in *A* is moved over to the *B* position and a new block put in the *A* position. A sliding shelf is provided at *C* for loading purposes. The shelf is pulled toward the operator and the block is located over two dowels; then the shelf is pushed into the fixture. The clamping is done entirely by air, the valves of the two clamping devices being operated independently.

This set-up gives an idea of the possibilities of combining operations on a multiple drilling machine, so as to utilize the full capacity of the machine at all times.

Device for Cutting-Off Pins

By O. Holm

Some time ago we were required to fill an order for several thousand pins 3 in. long, to be cut from $\frac{7}{16}$-round brass rod. Since we had no shears that could be run fast enough to allow us to make a profit on the job, we made the rod cutter shown in the accompanying sketch and put it in the shaper, holding the lower blade in the vise.



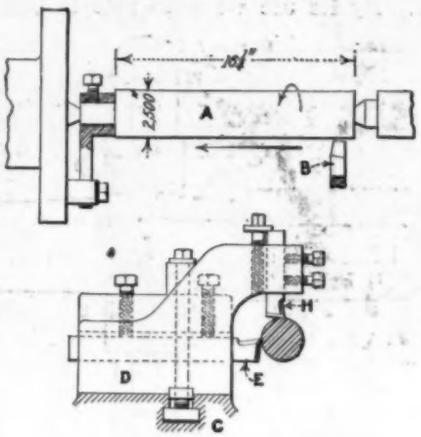
Rod cutting device

With the shaper running at 60 strokes per min., we were able to cut off the pins at a satisfactory price to the customer and make a profit for ourselves. The cutting blades were made from the leaf of a $\frac{3}{4}$x2-in. automobile spring. No alteration was made to the shaper in applying the device, since the upper member was held in the toolpost in the regular way.

Roughing and Finishing Tools

By Howard S. Evans

Ordinarily it is not considered good practice to attempt to rough and finish turn simultaneously, the theory being that hard spots affecting the roughing tool will also cause inaccuracies in the finishing tool. Sometimes conditions permit such a combination, as in the example given here, where a number of cold-rolled shafts *A* were originally rough turned on centers with a tool *B* and the inaccuracies were found to be so great that a finish cut on another lathe was required.



The work and the toolholder

The work was subsequently ground to size and an allowance of from 0.012 to 0.015 in. for grinding, was desired. With a roughing cut only, the shafts varied from 2.508 to 2.515 and sometimes the tool marks would not clean up in the grinding. To overcome the trouble, I designed the rough and finish turning tool shown at *C*, which was mounted on the cross slide of the lathe. The block *D* is a substantial casting having a slot in it for the roughing tool *E*, which is held down by two ½-in. screws. The finishing tool *H* is vertical and has an adjusting screw above it to allow accurate setting.

The tools are so arranged that the finisher can be set to cut from ⅛ to 1/16 inch after the rougher. In practice, the rougher was set to cut 0.005 in. larger than the finisher and no difficulty was found in keeping the size within a tolerance of 0.002 in. which was sufficiently close for the requirements. By setting up two lathes with the same kind of a device and using an extra dog, in order always to have one piece in readiness when either lathe completed its work, it was found that production was nearly twice that by the previous method.

Skinning Insulated Wire

Francis C. Henry

Removing insulation from wire by the usual method of using a knife, or even by special pliers having serrated jaws, is a tedious process and is apt to be more or less unsatisfactory. Every manufacturer of electrical apparatus has probably had the same trouble.

So one of the men in the plant of the Robbins & Myers Co., Springfield, Ohio, built the machine shown herewith. It consists of two shafts set one above the other, each carrying a wire brush and each driven by an independent motor. As the motors are in reverse position at each end they automatically run the brushes in opposite directions so that any insulated wire ends getting between the two are promptly deprived of their covering—or, in the language of the shop—"skinned."

The wire brushes are covered by a guard to protect

Machine for skinning insulated wire

the operator and also to prevent the particles of insulation from making a miniature snow storm in the vicinity of the machine. A suitable opening in the guard allows the operator to insert all the wires at the end of the coil at once, and these wires are cleaned rapidly and thoroughly, ready for soldering to the commutator bars in the sub-assembly department.

Improvised Electric Drive for a Planer

By Milton Wright

A planer was needed for a more or less experimental job in a part of our shop where there was no moving machinery and where it would have been quite inconvenient to install an overhead drive of any kind. An electric drive, with reversing motor, would meet the conditions admirably, but owing to the possible temporary nature of the work the management did not look with favor upon the purchase of such a machine, especially as there was already a perfectly good planer of

Fig. 1—The reversing mechanism

the "second belt" type in another part of the factory.

The superintendent did a lot of hard thinking, which called up visions of countershafts on the floor, countershafts under the floor, countershafts mounted on top of the planer housings—all possible and some impossible places where a countershaft might be—and in the end he conceived the quite commendable scheme of converting an old, belt-driven planer into an electrically driven machine with little expense and no delay. The following is a detailed description of just how the job was done and of the inconsequent changes necessary to be made in the machine itself:

In a nearby storehouse there was a small Westinghouse elevator-motor and its equipment that wasn't working. This motor was brought in, and the planer before mentioned was also brought in and set up in the position where it could be used to best advantage. The first shaft of the planer, with its tight and loose pulleys, was taken out and the belt-shifting forks removed from the shipper rod, these being the only changes made in the machine.

How the Reversing Switch Operated

In the place where the pulleys had been, the control box of the motor was rigged up as shown in Fig. 1, being supported by a skeleton panel of wood, bolted to the floor. The reversing switch was rigged so that the lever would be thrown by the movement of the shipper rod, by means of a single finger setscrewed to the rod and extending between the two rollers, as can be seen in the illustration.

The motor, Fig. 2, was mounted on a couple of short timbers bolted to the floor on the opposite side of the planer, and its pulley was belted direct to the large

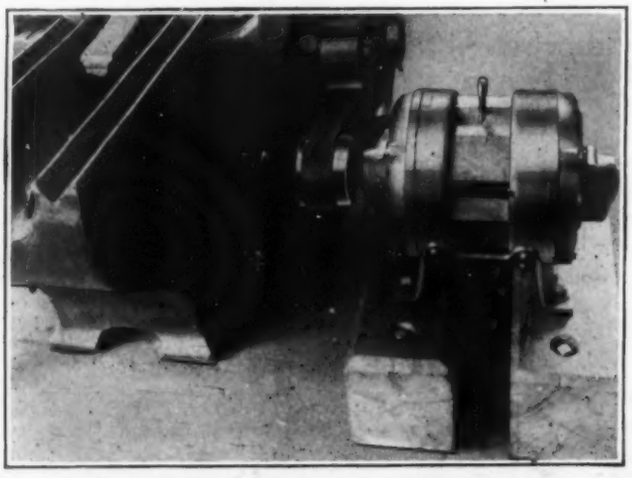


Fig. 2—Elevator motor driving planer

pulley on the end of the second gearshaft of the planer, replacing, in fact, the "second" belt of the original drive. The now unused bearings of the first shaft, bushed with insulating material, offered a very convenient passageway for the cable that connects the motor with the control box.

The planer went into service without experiment or difficulty, and no trouble has since developed. The table reverses promptly—even more so than with the original drive. The sudden reversal of direction of the motor at full speed causes a jar that is quite perceptible to anyone standing near it, but the belt cushions the shock so that none of it is transmitted to the planer. Altogether, the machine performs in a very satisfactory manner.

A Quick-Acting Expansion Mandrel

By Mervin J. Fulton

In a deep-well turbine pump, the vertical drive shaft is supported in bearings placed in oil-tight casings, one at every five feet. The bearings are bored, reamed and faced at one end.

We tried various methods of holding the bearings while the turning and threading were being done, and at last we designed the expansion mandrel shown in Fig. 1. By its use we were able to hold the bearings so

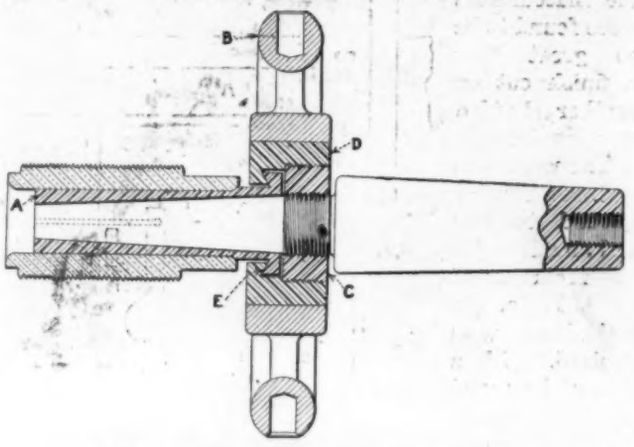


Fig. 1—Details of expanding mandrel

they could be machined accurately, and, owing to its quick action, production was increased 100 per cent.

The body of the mandrel has a taper shank to fit the machine spindle, the other end being tapered to expand the split sleeve *A*. The handwheel *B* has blind holes drilled in the rim for the insertion of a pin, so as to obtain greater leverage if necessary. The nut *C* was made separately to simplify machining the interior of the thrust ring *D*. When the handwheel is turned in one direction, the sleeve is expanded in the work.

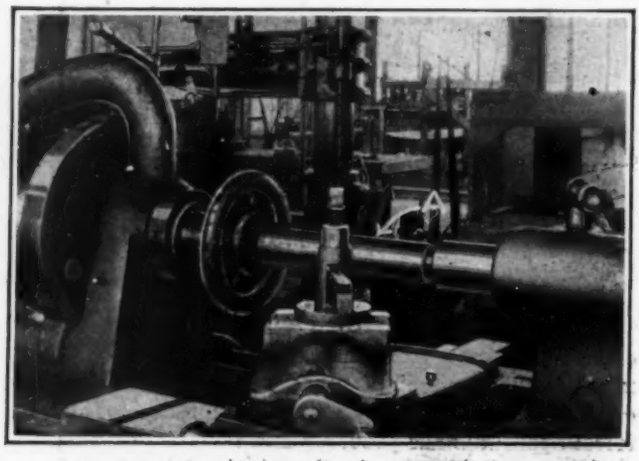


Fig. 2—Expanding mandrel in the lathe

When turned in the opposite direction the work is released. By turning the collar of the expanding sleeve and its mating part in the thrust ring at an angle, as at *E*, the sleeve draws in easier.

The mandrel is shown in place in the lathe in Fig. 2, the bearing to be turned being indicated at *A*. The mandrel has been used for making several hundred bearings, and no wear is noticeable as yet.

Standard Types of Grinding Wheels

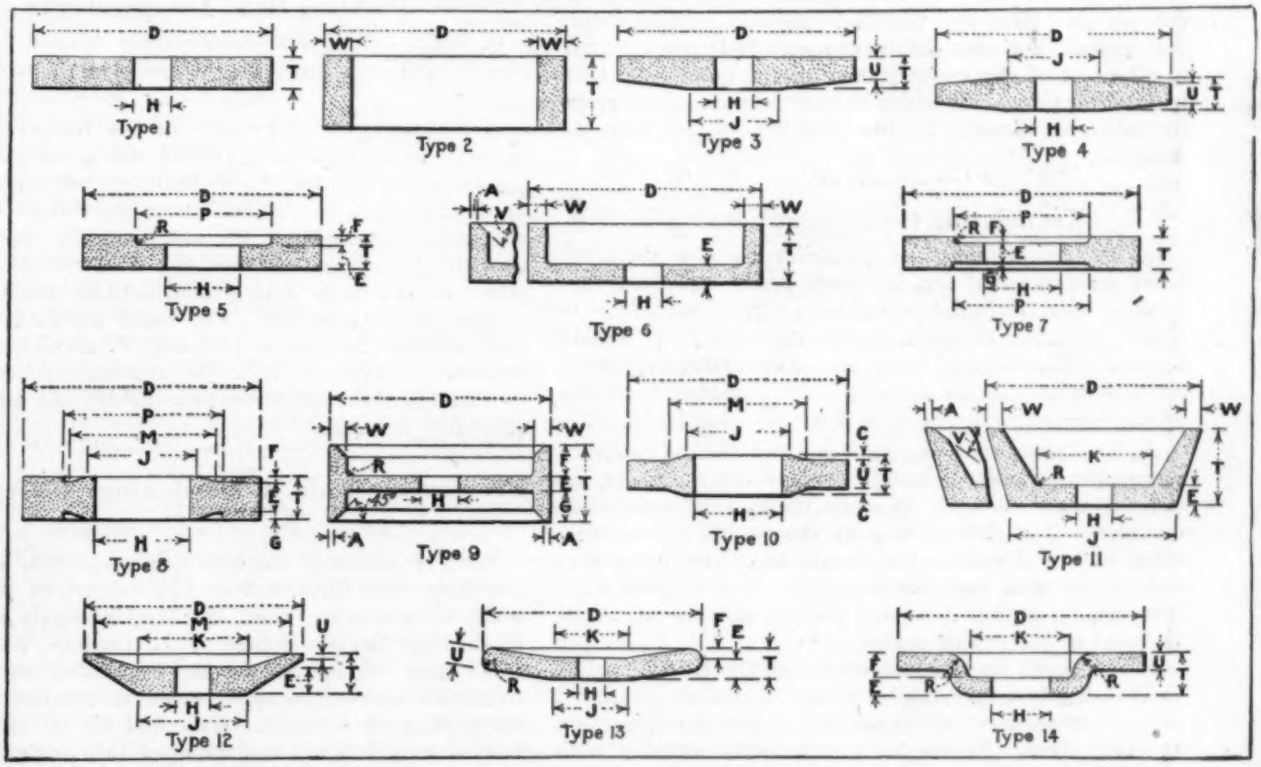
Simplified Practice Standards

Fourteen types of wheels have been adopted by the Simplified Practice Committee of the Bureau of Standards, working in conjunction with a conference of manufacturers, as being representative of grinding wheels for all uses on standard makes of machines. The purpose of the simplification is to reduce stocks and to enable the user to order accurately a grinding wheel by giving the type number and the complete dimensions. Limiting dimensions recommended for spindles are given in Tables I and II. The wheel types, designations, and standard letter dimensions used for ordering wheels are shown in the illustration. New wheels and grinders will conform to the simplified list of types and sizes.

Table I—Minimum Sizes of Spindles. Table II—Minimum Sizes of Internal Grinding Arbors

Wheel Diam., Inches	Thickness of Wheel, Inches																	
	¼	⅜	½	⅝	¾	1	1¼	1½	1¾	2	2¼	2½	2¾	3	3¼	3½	4	4½	5
6	½	½	½	½	½	½	⅝	⅝	¾	¾	¾	¾	¾	¾	¾	¾	1	1	1
7	½	½	½	½	⅝	⅝	⅝	¾	¾	¾	¾	¾	¾	1	1	1	1	1	1
8	⅝	⅝	⅝	⅝	⅝	⅝	¾	¾	¾	1	1	1	1	1	1	1	1¼	1¼	1¼
9	⅝	⅝	⅝	⅝	¾	¾	¾	1	1	1	1	1	1	1¼	1¼	1¼	1¼	1¼	1¼
10	¾	¾	¾	¾	¾	¾	¾	1	1	1	1	1¼	1¼	1¼	1¼	1¼	1¼	1½	1½
12	¾	¾	¾	¾	¾	1	1	1	1	1	1	1¼	1¼	1¼	1¼	1¼	1½	1½	1½
14	⅞	⅞	⅞	⅞	1	1	1¼	1¼	1¼	1¼	1¼	1¼	1¼	1½	1½	1½	1½	1½	1½
16	..	..	..	..	1¼	1¼	1¼	1¼	1¼	1¼	1½	1½	1½	1½	1½	1¾	1¾	1¾	1¾
18	..	..	..	..	1¼	1¼	1¼	1½	1½	1½	1½	1½	1½	1½	1¾	1¾	1¾	1¾	1¾
20	..	..	..	..	..	1½	1½	1½	1½	1½	1½	1¾	1¾	1¾	1¾	1¾	2	2	2
24	..	..	..	..	..	1½	1½	1½	1¾	1¾	1¾	1¾	1¾	2	2	2	2	2	2
26	..	..	..	..	..	..	1½	1½	1¾	1¾	1¾	1¾	2	2	2	2	2¼	2¼	2¼
30	..	..	..	..	..	..	..	1¾	1¾	2	2	2	2	2	2¼	2¼	2½	2½	2½
36	..	..	..	..	..	..	..	..	2	2¼	2¼	2¼	2½	2½	2½	2¾	2¾	3	3

Wheel Diameter, in Inches	Arbor, in Inches
1	⅛
1	¼
1¼	⅜
1½	½
1¾	⅝
2	¾
2	1
2½	1¼
3	1½
3½	1¾
4	2
4	2¼



Type 1—Straight, 2—Cylinder, 3—Tapered one side, 4—Tapered two sides, 5—Recessed one side, 6—Straight cup, 7—Recessed two sides, 8—Countersunk dovetail, 9—Double cup, 10—Raised dovetail, 11—Flaring cup, 12—Dish, 13—Saucer (Saw gummer), 14—Offset

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Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Learning to Be a Toolmaker

Q. I am a young high school graduate, and would like information regarding toolmaking. How can I go about learning the trade, and what are the advantages of this trade?

A. The most natural course would be for you to apply for a position in a machine shop in the nearest industrial center. It is not entirely necessary for you to wait until you can formally take up an apprenticeship course. The practical work that you will get in the shop can be supplemented by reading books and trade papers, by correspondence courses, and by a course in a manual training school. Most of the cities in the industrial centers now have night schools with practical machine courses. We suggest that you write to the Boards of Education in several nearby cities for information on the educational facilities which they have to offer for mechanics.

Regarding the opportunities for toolmakers, you should visit a few machine shops and talk personally with some toolmakers, machine designers, and shop foremen. It is difficult to advise anyone to enter any particular trade since everything depends upon the individual's own likes and dislikes. We can say, however, that toolmakers now obtain comparatively good wages in all parts of the country, and that a good toolmaker with a fair education and a desire to learn might readily advance himself to the position of foreman or designer.

Translating the Export Catalog

Q. We occasionally get inquiries on our machines from foreign countries, but have never made a direct foreign sale, although we have shipped machines to South America through orders received from export houses. Should we have our advertising circulars printed in several languages? What is the experience of other manufacturers in making direct sales?

A. The nature of the product and the advisability of spending money to build up a foreign trade are the two factors most likely to settle the catalog translation question. It is difficult to gage the results of a catalog sales effort. Possibly the South American firms that ordered through export houses were sold by your English catalog rather than by individual sales effort on the part of the export company.

It can easily be demonstrated that the translation of the catalog is a very minor factor in making an export sale of machinery, although this might be important in other lines. Desire for a responsible shipper with facilities for financing is the chief reason why foreign buyers go to agents or export houses rather than to send their order direct to the factory. The services rendered by the experienced export house in these and other respects are generally worth the commission to the manufacturer as well as to the foreign buyer.

The American manufacturers that have large export sales usually have their catalogs translated through their agents in the foreign country. Thorough familiarity with the local language and customs, and with the technical terms used are necessary on the part of the translator. A catalog must be well translated or not done at all, and a catalog in Spanish for circulation in Argentina or Chile must not be full of colloquialisms used in Mexico. Machinery importers in practically every part of the world are familiar with catalogs in English, and until you are ready to have a nearly perfect translation made, it is preferable to stick to the well illustrated English catalog that you know is correct.

Until you have definitely established agencies your price quotations should be in dollars. Endless trouble results from long-distance conversions of prices. The "peso," for example, has eight distinct values in South America alone, besides an almost daily fluctuation in exchange value.

Pickling Bath Temperatures

Q. What is the best temperature to use for a sulphuric acid pickling bath for pickling iron and steel articles?

A. Practice varies greatly in the temperature employed. Some picklers prefer to use a temperature as low as 100 to 120 deg. F., while others use temperatures up to 180 deg. F. Experiments show that the time necessary for pickling increases rapidly as the temperature is reduced. In fact the temperature has more effect on the bath than a considerable change in the acidity of the solution. For rapid pickling a 20 per cent solution heated to 180 deg. F. should give good results. A drop of 40 or 50 degrees in temperature in this solution will more than double the time necessary for pickling.

Preventing Scale in Hardening—Discussion

By C. E. Coats

With reference to the article on page 258, Vol. 65, of the *American Machinist* on the subject of preventing scale in hardening, what the steel needs is something to shut out the gas fumes of the furnace, while at the same time not influencing the hardening process. An oxidation preventive agent is on the market that will accomplish this result. The tool to be hardened is heated to a dull red and plunged into the paste. The thick coating of the compound then bakes on and prevents the formation of scale when the steel is raised to the hardening temperature. The quenching will remove the compound from the steel.

Technical Abstracts

Human Engineering

Industry today demands human understanding, if mankind is to keep pace with the gigantic strides made along mechanical lines. Inventive genius has created, and is still creating, so much machinery that is revolutionizing our methods of doing things, that executives have been forced to give a great deal of thought and time to the study of what is sometimes called "Human Engineering." The growth of business from small concerns to large corporations has been another factor in quickening the need for a more general understanding of what goes on in the worker's mind.

There is no longer an opportunity for the executive to meet all the men individually under his supervision. Modern life has a tendency to repress what is generally known as the creative impulse. The desire to create is as fundamental as life, for life is creation. If you can paint to each individual worker the picture of the part his job has in the whole manufacture of an article, I believe you will have changed him from a routine worker into a creator. Give the worker the proper viewpoint of his job, and you have done much to prevent discontent and labor turnover.

Whenever you find a man satisfied with his lot in life, there is likely to be something wrong with him. The desire to advance in his chosen work is at the bottom of the heart of every thinking individual. Snuff out that desire and you have a disgruntled workman.

If when an executive is placing a new regulation into effect, he will place himself honestly in the position of those affected, I believe his reaction will very nearly approach those most deeply concerned. This is a fundamental step in the study of human engineering, to know that under similar circumstances almost all mankind will react the same.

Most of our working hours are spent in dealing with human nature, investigating, inspecting, influencing, correcting or disciplining men. It is not the amount of discipline, but the way it is handled by the local officers that determines the reaction of the man involved, and therefore a large amount of tact is required.

We are dealing with human beings, and we all have similar aims and desires. We are selling our services in return for a stipulated wage. We all have ideas concerning our jobs. If the jobs are to our liking and we become enthusiastic about our work, there is little question about our efficiency.

Because we are creatures of habit, we like to have some regularity about our work and methods. Nevertheless, we like to have some new interest, some new problems to master, to keep life from becoming too monotonous. We all want to be treated like human beings, not as mere cogs in a machine, nor as a commodity. Each man likes to feel that he is an individual performer and that the character of his work is known to his superior.

There are two virtues, and I call them virtues advisedly. One is common sense, and the other is a sense of humor. They will help you over many a hard road. You can often josh a man out of a thing when you can't reason him out of it, or you may be able to ridicule him out of it, when you can't talk logic to him.—Elisha Lee in *Engineers and Engineering*, Aug. 15, 1926, p. 219.

Blueprints and Van-Dyke Prints

With present-day methods involving continuous blueprinting, washing and drying machines, blueprints can be finished at a rate of 6 to 8 linear ft. per min., and at a cost of 1.3 cents per sq.ft. One-hour service on 35 per cent of the requests for prints and two-hour service on 65 per cent of the requests can be maintained with a daily output of 1,000 prints or more.

The element of time and service raises the question of the advisability of stocking prints. Blueprint files occupy valuable space, and there is no assurance that they are always up-to-date. Some companies maintain them as fire files at a different location than the tracing files.

A better system is proposed, involving the use of Van-Dyke prints, filed in proximity to the blueprinting machines. The tracings are kept in the drafting room. The background of the Van-Dyke is a reddish brown and the lines are white. Blueprints can be made from them that are more legible than those obtained from the original tracing, particularly to a novice. If the tracing is destroyed, it can be reproduced from the Van-Dyke by any of the photolitho processes. Incidentally the wear and tear on the tracings are reduced considerably. Van-Dykes cost about three times as much as blueprints, and this is their only drawback.—A. A. McCormack in *Manufacturing Industries*, August, 1926, p. 133.

Heating and Ventilating of Machine Shops

The heating and ventilating of large rooms in which various kinds of machines are installed offers difficulties that cannot be overcome without great care. This is especially true where the heat is derived from fixed radiators or heaters.

The temperature of this class of shop in the interest of hygiene, should be about 64 deg. F. Also the humidity should be kept within definite limits. According to Pettenkofer the best condition of the air in workrooms is met when the humidity is fixed at 60 per cent.

In the neighborhood of the heaters the temperature is generally too high, while at a little distance away it is too low. One usually finds a complaint also that in a drafting room or model room it is too cold to work at a distance from the heaters. The warmth does not radiate out from the heaters, but goes up to the ceiling in small columns of hot air.

This subject has been given attention lately by German manufacturers, and several air heaters and ventilating installations are now shown that give satisfaction in machine shops. The apparatus described, in general, heats the air to the proper temperature and pumps it to strategic points in the shop where it is distributed through ventilators.—*Die Werkzeugmachine* (Berlin), July 30, p. 356.

American Machinist

KENNETH H. CONDIT AND FRED H. COLVIN
Editors

Established 1877

Misused Light and Abused Sight

THE most casual observation here, there or anywhere reveals the fact that one of the most prevalent characteristics of lighting is its misuse. The fact is particularly true of artificial light, because its sources can be so readily moved around and neglected. The prevalence of this condition can best be accounted for by a general lack of lighting consciousness on the part of operators and executives. Light and vision are such commonplace experiences that most persons go through life with scanty consciousness of them. The sun is so very bright that we dare not look at it and the sky is generally of a harmlessly low brightness. During countless centuries mankind has formed habits that should be given attention in the present age of controllable artificial light.

A bare incandescent filament lamp in the direct field of vision not only decreases the ability to see accurately, quickly and safely, but it impairs eyesight and unfavorably affects the nervous system. In metal industries, and in some others, the reflected images of the light-sources are also annoying. This annoyance is reduced by diffusing the light and is entirely eliminated if the lighting unit can be properly located. Illuminate the work—not the eyes—is a recommendation of far-reaching importance.

Progress in Jig and Fixture Practice

TWO comparatively recent developments in the use of jigs and fixtures show how closely the executive of the metal-working shop must follow the practice of his industry if he is to keep up with the procession. Both of these developments apply with more force to the small-lot shop than they do to the production shop.

The first development is the welded jig. Made from standard rolled-steel shapes it costs but a fraction of the price that must be paid for a well-finished jig constructed along conventional lines. It is crude in appearance but it can be put together in a few hours as against as many days for the cast jig. As a consequence it can be used to advantage on a number of pieces so small that the standard type of fixture would be out of the question from the expense standpoint.

The other development is the elimination of the fixture from small-lot production. In a well-known shop it was found cheaper to use the horizontal boring machine with its accurate feeds and traverses directly on the work. In other words, the pieces were machined as if they had been fixtures. It must be remembered in this case that the number of pieces in the lot was very small and that the machinists were above the average in skill. Careful analysis of costs showed that it was cheaper to do the work in this way than to construct the fixture, store it, withdraw it from storage, set it up and return it to storage. The practice would not be applicable to many shops, perhaps, but it should save money for those where it could be adopted.

Improving Government Specifications

THE response to the editorial on specifications appearing on page 70, Vol. 65, is gratifying because it has shown that some departments have already adopted sane specifications, and that others desire to be shown where they are in error. More encouraging still is the attitude that welcomes suggestions and even criticisms, in the knowledge that it is our desire to aid in improving the service, by pointing out what seems to be faulty practice.

It has been our privilege to be rather closely connected with various government departments for many years. During that time the practices have been greatly improved and in some departments have reached a point that might well be copied by many private concerns. And in spite of criticisms in the past, the most friendly relations exist between these departments and their critics.

The spirit that welcomes criticisms and suggestions in order to improve existing conditions such as is now being shown regarding the editorial in question, is evidence that we may look for the same improvements in other departments.

Just Suppose

JUST Suppose that all the builders of industrial equipment had studied their markets so carefully that they knew exactly where to direct their strongest sales efforts instead of wasting a large part of them on prospects of very doubtful worth. Just think of the simplification of styles and sizes that would result, of the reduction of inventories that would surely follow!

Why talk so glibly of ideals, you ask? Well, no practical success has ever been achieved without some thinker having visualized it beforehand.

Perhaps it will take many years to realize this ideal but just suppose we could cash in on its benefits now—

Just Suppose

Shop Equipment News

LeBlond "Rapid-Production" Lathe, 16-In.

The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio, is marketing the 16-in. "Rapid Production" lathe illustrated in Fig. 1. It is designed for the quantity production of plain turning and facing work. Some of its features are: a geared head mounted upon roller bearings; automatic lubrication to the headstock, feed, and traverse mechanism; and power rapid traverse for the carriage and cross-slide.

The headstock is of the selective-speed type, with six changes of spindle speed obtained through sliding gears manipulated by means of two change levers. The gears are made of high-carbon alloy steel, heat-treated. They slide on multiple-splined shafts of high-carbon steel. All the shafts are mounted upon Timken tapered roller bearings. Automatic flood lubrication is provided for the gears in the headstock.

The drive is through a multiple-disk clutch incorporated in the driving pulley. A quick-acting friction brake is also contained in the pulley, and is automatically engaged upon release of the clutch.

The machine is furnished with a geared feed mechanism. The drive is taken from one of the headstock intermediate shafts through a quadrant and system of change gears. Twenty-seven feeds are provided, ranging from 0.003 to 0.108 in. per revolution. The coarse changes are made by means of the gears on the quadrant, while the intermediate and fine changes are made by shifting a lever on the front of the headstock.

The power rapid-traverse mechanism is incorporated in the feed mechanism. It is driven by means of a belt from the driving pulley. The traverse is engaged by means of a lever at the side of the apron that shifts a double-jaw clutch. The traverse is effective in either direction on both longitudinal travel of the carriage and cross-travel of the slide. The same lever is used to engage the length and cross-feeds. Adjustable automatic traverse safety stops are provided, and since both the feed and traverse are controlled by the same lever, they are automatically interlocked. The feed and traverse mechanism is automatically oiled by flood lubrication.

The apron is also flood lubricated. It is a single-piece box casting of the double-wall type as shown in Fig. 2, and is partially filled with oil, so that the apron gears run in a bath of oil. In addition, a submerged geared pump provides forced lubrication to the carriage and cross-slide bearings. This pump is positively driven while the feed is engaged and is effective for travel of the carriage in either direction. Six heat-treated steel gears are provided on the apron, while the rack pinion is of chrome-nickel alloy steel, heat-treated. The gear shafts are supported at both front and rear.

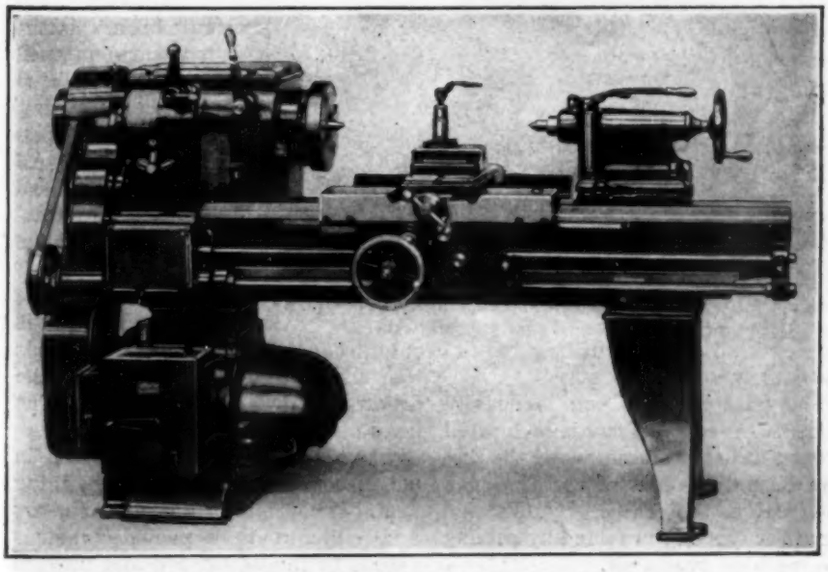


Fig. 1—LeBlond "Rapid-Production" Lathe, 16-Inch

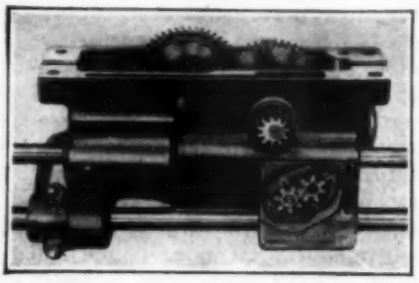


Fig. 2—Rear view of apron showing geared pump

The feeds are controlled by means of a lever at the side of the apron. A convenient knob for shifting a sliding gear is also provided as a means for changing from longitudinal to cross-feed. The apron handwheel has a positive clutch, which can be disengaged by withdrawing the handwheel from the engaging position, so that the wheel will not revolve while the feed or power traverse is engaged. The apron is located on the carriage by means of a tongue and groove and dowel pins.

The bed incorporates this company's so-called "Compensating Vee" construction on the front shear. This design is said to provide a large carriage-bearing area. It also provides a thrust bearing approximately at right angles to the tool pressure on all diameters within the swing of the lathe. The bed is braced by numerous box-section cross girths.

The carriage has a long bed and a large cross-slide bearing, both of which are oiled by means of forced

Shop Equipment News

lubrication supplied by the pump in the apron. The surplus oil overflows into a reservoir in the carriage bridge, whence it flows back to the apron after being filtered. The oiling is automatic and hand lubrication is said to be eliminated.

The tailstock is screw-operated and is of the setover type. Two screws are provided for setting over the tailstock, and the top is graduated so that the amount of setover can be measured. The tailstock is clamped in position by means of two bolts. The spindle is of large diameter and is made of high-carbon steel.

A plain block rest and a single screw tool post are regularly furnished. The rest is bolted to the bottom slide and is located in position by means of a tongue and groove. It is adjustable along the bottom slide and has four bolts for holding the rest in position. Other attachments, such as a compound rest, taper attachment, lever-operated tailstock, oil pan, pump and piping, turret tool post, draw-in attachment and collets, and motor drive can be furnished when specified.

Two kinds of motor drive are offered: a constant-speed, geared motor drive mounted on top of the headstock, driving a large gear that replaces the driving pulley, or a constant-speed, belted motor drive for either a.c. or d.c. service. The latter type of drive is illustrated in Fig. 1. The motor is housed in the base of the front cabinet leg. It is semi-inclosed. An idler pulley is provided for increasing the contact area of the belt on the pulleys and to provide adjustment. A 5-hp., 1,200-r.p.m. motor is recommended.

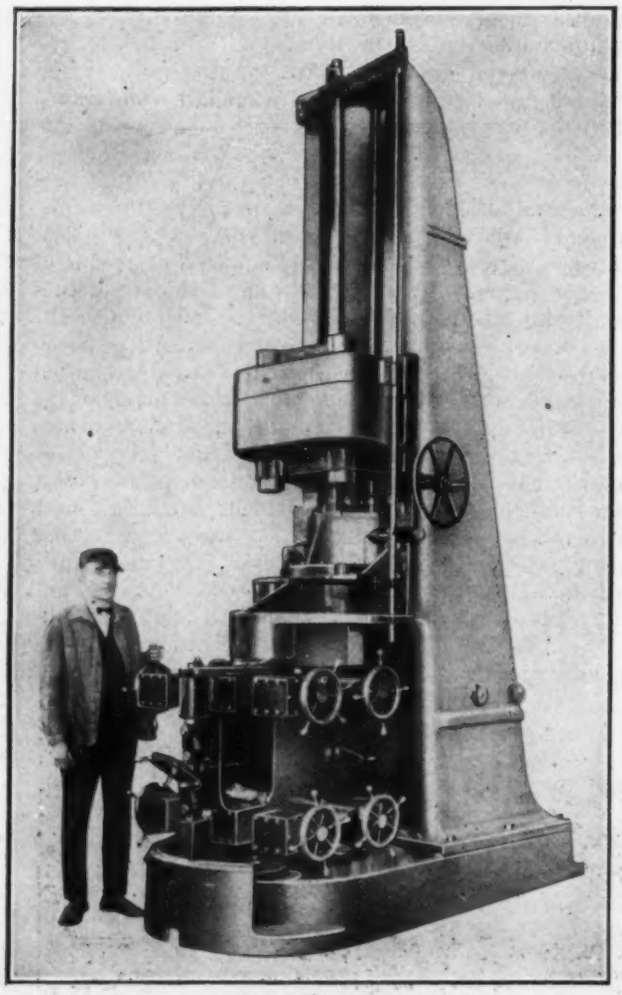
The lathe swings work 17¼ in. in diam. over the shears and 10¼ in. in diam. over the plain block-rest slide. With a 6-ft. bed, it takes work between centers up to 2 ft. 9 in. in length.

The driving pulley is 10 in. in diam. and takes a 3-in. belt. The normal pulley speeds are 400 to 600 r.p.m. Six spindle speeds are provided with a range from 47 to 450 r.p.m. The spindle is hollow with a 1⅛-in. diam. hole and is regularly supplied with a No. 4 Morse taper.

The shipping weight of the lathe is approximately 1,900 pounds.

Hoefer Deep-Hole Drilling Machine

The machine shown in the accompanying illustration was designed by the Hoefer Manufacturing Co., Freeport, Ill., for the drilling of holes 2½ in. in diam. in cast bronze ingots 40 in. in length. The machine consists primarily of a base, column, two-spindle head, and a rotating trunnion with work-holding fixtures. While the machine was built for a specific purpose, it can be adapted for any kind of deep drilling requiring equipment of this size.



Hoefer Deep-Hole Drilling Machine

The base is deep and is heavily ribbed. A coolant pump is located underneath the column, while the section around the trunnion is arranged to receive the chips. Additional room for chips is provided by setting the machine over a pit.

The column is of heavy section with three cross ribs to prevent any distortion. The ways on the front of the column are scraped to provide bearing for the head. An overhanging arm is fastened to the column to provide an upper bearing for the trunnion, a base for the feed box, and a guide bearing for the boring bar. A platform for the motor is also mounted on the column.

Power is transmitted direct from the motor through a 2-pitch bevel pinion, made of Micarta to insure quiet operation, to a large bevel gear. The bevel gear drives a vertical splined shaft, which in turn drives the main driving gear in the head by means of a heavy sliding key. The key is fastened in the gear. Ball thrust bearings are provided to take care of the thrust from the bevel gear.

The two-spindle head is of heavy construction. The spindles are made of heat-treated alloy steel and are ground on essential dimensions. The spindles are mounted in "Non-Gran" bronze bushings and are equipped with No. 4 Morse tapers. The drilling thrust is taken upon ball bearings. All gears within the head are made of heat-treated alloy steel and are cut with 4-pitch teeth. The main driving gear is of quill construction. The hub extends the full length of the head, so that the driving key does not tend to cock. The head operates in a bath of oil.

The feed mechanism is housed in a box contained in the overhanging arm. It consists of a series of gears and clutches that provide various speeds to the downward and upward motion of the head. The feed is

Shop Equipment News

effected by means of a lead screw running in bronze bearings with ball bearings taking the thrust in both directions. The gears and clutches are made of heat-treated steel. The feed is controlled by means of a lever convenient to the operator. The length of the work stroke is determined by two adjustable collars on the trip rod. In addition, fixed safety collars at both ends prevent damage to the machine from overtravel. The feed can be started, stopped, or reversed at will by the operator, but if once started it will reverse automatically at the end of the down stroke and will stop automatically at the end of the rapid-return stroke. A large handwheel is also provided at the right of the machine for operating the head by hand.

The rotating trunnion contains four work-holding fixtures. The fixtures consist in each case of four hardened steel Vs operated simultaneously by right and left-hand screws by means of small handwheels. These Vs slide in scraped bearings to insure proper alignment, and they center the work under the spindle. The trunnion rotates on a special roller bearing and is held radially in bearings in the machine base and in the overhanging arm on the column of the machine. A large hardened and ground plunger engages a hardened steel bushing in the trunnion and locates it in position by means of a toggle arrangement after the trunnion has been indexed. Two tubes are bored simultaneously while the operator removes the two finished pieces and inserts new ones.

An ample supply of coolant is furnished by means of a geared pump mounted on the column. The machine occupies a floor space of 40x 98 in. The overall height is 160 in. It weighs approximately 16,000 pounds.

American "MonoRail" Track

The American MonoRail Co., West 67th St. & Pear Avenue, Cleveland, Ohio, is marketing an improved form of rail designed for overhead hand-power monorail systems. The "MonoRail" consists of two twin steel sections rolled from rail steel. The two sections are bolted together,

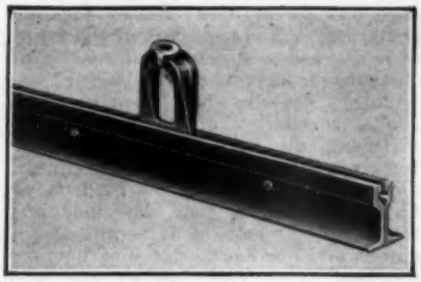


Fig. 1—American "MonoRail" Track

back to back, to form a single unit. It is claimed that the sections have been so designed that the rail is capable of bridging wide spans and sustaining rated loads without deflection. Figs. 1 and 2 show views of the device.

The high vertical web of the assembled MonoRail is said to result in great carrying strength. Its narrow width of two inches, however, is said to make bending easy to meet any layout requirements. The holes for the clamping bolts are slotted so

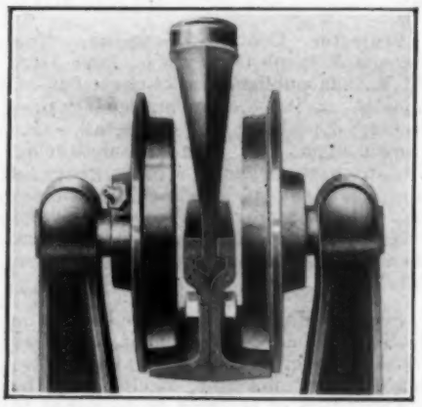


Fig. 2—Cross-sectional view of the rail

that the bolts are relieved of any shear stress when the sections are bent. Standard bent sections can be furnished for all regular curves and for irregular curves where the conditions are specified.

The clamping bolts and nuts are self-locking. The bolts have a square shank that fits in the slotted hole in the rail section. The nuts are of special design and are double-locked when tightened. The nuts may be loosened with a wrench.

The supporting hangers are made of steel forgings. They are assembled in the rail head as can be seen in Fig. 2. The spacing of the hangers can be changed to meet any suspension requirements. The hangers are adapted for plain strap or adjustable bolt suspension. They are clamped inside the rail head so as to allow ample room for the trolley wheels, without interference.

The MonoRail has overlapping end connections, and it forms a continuous runway without broken joints and without the use of splice clamps. The connecting joints are staggered on opposite sides of the rail, so that trolley wheels do not cross joints on both sides of the runway at the same time. Hanger supports are placed at splicing points so as to prevent deflection of the rail.

Morris Gravity-Lowering Chain Block

The gravity-lowering chain block illustrated is being marketed by Herbert Morris Incorporated, Buffalo, N. Y. The hoist is designed in five sizes, ranging from ½ to 5 tons in capacity. It is claimed that even the 5-ton block will gravity lower with only 14 lb. on the hook.

The frame is made of rolled-steel

Morris Gravity-Lowering Chain Block

plates and forgings. The hoisting mechanism consists of a worm and wheel. The wormwheel is made integral with the load-chain wheel. The worm has a double thread, and its lead is large enough to allow the

Shop Equipment News

worm wheel to drive it when a load is placed upon the hook. The worm and shaft are turned from the solid and are heat-treated and ground. The thrust is taken on ball thrust bearings. On one end of the worm shaft is mounted a centrifugal brake that keeps the lowering speed within safe limits, when the hoist load is allowed to drop by gravity. An automatic stop actuates a brake when the hook reaches its lowest position.

The hand-chain wheel is provided with a runaway clutch so that it does not move while the hoist is gravity-lowering. The load may be lowered in the usual way by pulling on the hand chain, in order to provide accurate placement of the load, when desired. An automatic brake on the worm shaft sustains the load whenever the hand chain is released. The pull at the hand chain for rated loads ranges from 75 lb. for the ½-ton hoist to 160 lb. for the 5-ton hoist. The lowering speed varies from 60 ft. per min. to 12 ft. per min., respectively.

The ½-ton hoist has a standard clear lift of 8 ft., while the 5-ton hoist has a standard clear lift of 12 ft. The smallest unit weighs 94 lb., while the largest weighs 435 pounds.

Trade Catalogs

Arc Welding Apparatus, Automatic. The General Electric Co., Schenectady, N. Y., has published Bulletin GEA-452 on its automatic arc welding apparatus. Twelve 8x10½-in. pages are devoted to description of the apparatus and its accessories. Numerous photographs and line drawings of the equipment are given, as well as wiring diagrams.

Motors, Direct-Current, Crane and Hoist. The General Electric Co., Schenectady, N. Y., has issued a four-page, loose-leaf folder on its direct-current crane and hoist motors, type CO-1820. The various units and parts of the motor are described pictorially with the aid of boxed references with arrows pointing to the particular parts. Complete ratings are given.

Motors, Wound-Rotor Induction, "900 Series." The General Electric Co., Schenectady, N. Y., has issued a leaflet on its wound-rotor induction motors "900 series" type MT, 3-phase, and type MQ, 2-phase. The principal features of the motors are pointed out by means of brief text and photographs.

Pickling Equipment. Duriron Co., Inc., Dayton, O., has published a 20-page bulletin entitled "Better Pickling Equipment." The first part of the booklet is devoted to a general discussion of the subject including acid buying, unloading, storage, and measurement. Tanks, ventilation of the pickling department, the acid sump and similar items are also considered in a technical way. The application of Duriron or Alcumite parts is then described and illustrated by means of numerous photographs and line cuts. Specifications for standard parts and fittings are also given.

Pipe-Threading Machine, "Red-E-Hall." Hall-Will, Inc., Erie, Pa., has issued a twelve-page bulletin on its new "Red-E-Hall" pipe threader. The various features of the machine are emphasized, and its construction is explained in detail. Numerous photographs are used to illustrate the text.

Pipe Tools and Machines. The Oster Manufacturing Co., Cleveland, Ohio, has issued list No. 35 on its pipe tools and machines. This list is in the form of a 48-page, 6x9-in. booklet provided with thumb tabs for easy reference. A brief description of each tool or machine is given, and numerous photographs are used to amplify the text. Complete specifications and prices are also given.

Projector, Contour-Measuring. The Bausch & Lomb Optical Co., Rochester, N. Y., has published a 38-page, 6x9-in. booklet on its contour-measuring projector, explaining it in detail. Its proper use for contour measuring various parts, such as screws, gears, is also explained at length. The booklet is well illustrated throughout and numerous typical examples of work done by the machine are brought out in this way.

Screw Machines, Automatic. The National Acme Co., Cleveland, Ohio, has issued a bulletin on its five-spindle automatic screw machine, model C. The construction of the unit is described in detail by means of numerous photographs. Complete specifications are given.

Table, Drop Pit. The Whiting Corporation, Harvey (Chicago) Ill., has issued a large size leaflet on its drop pit table. The use of the table for locomotive motor repair work is explained and illustrated by means of numerous photographs.

Threading Machines, Automatic. Rickert Shafer Co., Erie, Pa., has published Bulletin No. 11, series No. 1-S, on its automatic threading-machines. It is devoted chiefly to the R-S automatic single-threading and second-operation machines. The features of the machines are explained and the text is amplified by means of photographs.

Tool Catalog. The National Acme Co., Cleveland, Ohio, has issued a thirty-two page 6x9-in. tool catalog for its model A, No. 52-56 multiple spindle automatic screw machine. End-working tools, side-working tools, tools for the top slide, and various attachments are described and illustrated by means of numerous photographs. The particular use for each form of tool is made evident.

Tool Holders. The Gisholt Machine Co., Madison, Wis., has issued an illustrated leaflet on its tool holders for use with odds and ends of Stellite, Chesterfield, and High-speed steels.

Tools, Interchangeable. The Eclipse Interchangeable Counterbore Co., Detroit, Mich., has issued Catalog No. 22 on its interchangeable tools. The booklet contains fifty-two 6x9-in. pages and is thumb indexed for easy reference. Straight- and taper-shank holders, stop collars, safety and adjustable length holders, counterbores, countersink and two-lipped hogging cutters, and various angle cutters and end mills for die sinking work are described. Special combination tools are also included. The booklet is profusely illustrated. Complete specifications are given in every case.

Wood Miller, Universal, "Semi-Auto." Wadkin & Co., North Evington, Leicester, England, is distributing a twenty-eight page bulletin on its semi-automatic universal wood miller. The machine was particularly designed for pattern work, and numerous examples of this class of work are given with the aid of many photographs. Complete specifications for the machine and its accessories are supplied.

Pamphlets Received

Norton Service to Employees. The Norton Co., Worcester, Mass., has published a 37-page booklet under the title given above. The author is Dr. W. Irving Clark. He shows how the company takes care of the five chief worries of the workman—loss of his job, sickness and accident, debt, death, and dependent old age. Plant sanitation, lunch rooms, recreation, housing facilities, apprentice school, and other educational features are also discussed. The booklet is well illustrated by means of photographs, and is bound in a stiff paper cover.

Progress in Machine Forging. The National Machinery Co., Tiffin, Ohio, has published in pamphlet form a paper under the above title by Charles D. Harmon, engineer of that company. The paper was read before the Production Standards Division of the American Plan Association, Cleveland, Ohio, March 1, 1926. It discusses the merits of drop hammers as compared with forging machines. Particular attention is given to upsetting operations. The text is illustrated by means of photographs and line drawings.

News of the Week

Dr. Klein Will Make European Survey

In order to gather first hand information for the benefit of American business men engaged in trade with Europe, Dr. Julius Klein, director of the bureau of foreign and domestic commerce, sailed from New York on Sept. 1 to conduct an economic survey which will take him to twenty-seven European cities before his return to the United States. Among the important trade centers in which Dr. Klein will confer with officials and business leaders are Hamburg, Copenhagen, Vienna, Budapest, Bucharest, Constantinople, Sofia, Belgrade, Milan, Frankfort, Cologne and Paris.

Europe, with imports from the United States averaging well over 2 billion dollars annually during the past four years, and with receipts from this country totaling $2,604,000,000 in 1925, is by far the world's largest market for American goods. The prime purpose of Dr. Klein's trip is to assure to American business the continued receipt of timely and practical trade information.

Experiments Prove Strength of Screws

Ten thousand screws driven into seven different kinds of wood were tested for their holding power in a recent experiment at the Bureau of Standards of the Department of Commerce. The data obtained has been made available in a publication just issued.

A specially equipped testing machine was used in the experiments, pulling the screws from their settings and measuring their tenacity. Holding power, it was found, can be increased and the cost of making screws reduced by leaving them rough and unpolished. When holding power is most important, it was suggested that the user should select a rough screw, with thin, sharp threads, full diameter under the head, and with a shallow slot.

The screwed joint should be as strong as the wood. Screws set across the grain were found to hold a third better than when parallel to the grain.

S.A.E. Handbook Ready

The September issue of the "S.A.E. HANDBOOK" will be mailed to all members of the society on Sept. 15, this being the second issue of the handbook in the bound form. This issue will contain the specifications approved at the summer meeting of the society and adopted later by letter-ballot.

The September and future issues of the "S.A.E. HANDBOOK" will carry lists of the personnel of the Divisions of the Standards Committee. This personnel will be brought up to date with each new issue.

In the September issue will be printed a list of S.A.E. specifications that have been revised as a result of the society's action taken at the summer meeting and by letter-ballot.

The handbooks are to be mailed parcel-post, well protected in cardboard containers. Any copies of the handbook received in poor condition will be replaced by the society.

Clean Windows an Aid to Greater Production

The value of proper factory lighting, and in particular the effect of unclean windows on production, was the general theme of the twentieth annual convention of the Illuminating Engineering Society, which began on Sept. 7 at Spring Lake, N. J. It was brought out in a series of papers prepared by prominent engineers, that too little attention is given by executives to efficient lighting of rooms and buildings, and also to the regular and thorough cleaning of windows.

The value of keeping the windows of a manufacturing plant clean was demonstrated in a paper given by Messrs. Randall and Martin, engineers for the Detroit Steel Products Co. Messrs. Randall and Martin, in cooperation with Prof. Higbie of the engineering research department of the University of Michigan, conducted an investigation to determine the effect of dirt accumulation upon the daylight transmitting properties of glass windows. Part of the work was done in buildings and part with experimental models set up at the university.

Some of the interesting points brought out by the paper were: That after a period of 4 months with the windows unclean the amount of light which they would transmit was only 25 to 50 per cent of that for clean windows; that the rate of decrease in transmitting power was greatest when the windows had just been cleaned; that about 5 per cent of the decrease in transmitting power was due to dirt on the inside of the window; that the type of glass used made comparatively little difference in the amount of dirt collected.

The authors of the paper recommend that in case a yearly schedule for cleaning is maintained the cleaning should be done in the fall so as to let in the maximum amount of light during the winter months when it is most needed. They also advise a frequent schedule of cleaning the inside of the windows with a damp cloth as a very effective and inexpensive method for increasing the usefulness of windows.

Heat-Treatment Course Begins in October

The co-operative evening course in heat-treatment and metallography of steel, conducted at Temple University, Philadelphia, under the auspices of the Philadelphia Chapter, American Society for Steel Treating, begins its sixth season on Oct. 4. Its purpose is to afford men who are engaged in various lines of work, connected with the use and treatment of steel, an opportunity to keep abreast of the rapid scientific progress of the art, and to get a sound grounding in fundamental principles. Instruction consists of lectures and laboratory work.

A feature recently introduced is the advance class, for those who wish to go more deeply into the subject than is possible in the first year, or to take up more specialized investigations. In this class, students are encouraged to work out metallurgical problems arising in their own plants or industries, using the facilities of the laboratory, and having the guidance of the instructors, and the benefit of general discussion in the class.

Machines Replace Labor in Industry

That machinery is to an increasing degree replacing unskilled labor is shown by a report of the National Industrial Conference Board. It is declared in the report that during the two years that the two per cent quota act has been in effect, the largest loss in immigration has been in common labor which actually emigrated in larger numbers than it entered the United States.

From 1900 to 1914 the increase in employment kept a fairly steady pace with the increase in production. Although the volume of manufacturing output from 1921 to 1925 increased about 62 per cent, employment during the same period increased only 14.28 per cent. The percentage here given cannot be considered as exact but it does indicate the trend.

Research on Lean Iron Ores

Research on lean iron ores is to be made one of the major problems with which the Bureau of Mines will deal in a new program recently outlined by executives. It is closely associated with research looking to the development of methods which will allow the use of more domestic manganese. The pyro-metallurgical work will be done at Minneapolis, while the hydro-metallurgy will be done at the Reno station.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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THERE is so little to worry about in the business outlook that its very serenity inspires caution among the careful and experienced. Conversely, it is partly this caution that makes the prospect appear so serene. The two are so interlocked that many think business will continue stable and active as long as the rein of conservatism pulls on the bit. This is probably true. But it is less certain that the necessary self-control will be exercised indefinitely, for it is a human trait to "let the other fellow curtail," in industry as much as on the farm. In the past restraint has always broken bounds sooner or later and the overcanny, or careless and inexperienced, have carried others down with them.

The wise feel this danger at least subconsciously. Therefore they are not beguiled by the calm and are watching the horizon closely. The steel trade reviews, for example, convey a fear that recent buying "has been robbing the market of future possibilities." But it is not yet admitted that this is so, and it must be conceded that there are few clouds, even "no larger than a man's hand," in sight. In the record of last week appear none that are new—only old acquaintances such as the expected decline in building, fear of the debacle of installment selling, agricultural and political discontent and one or two others. All of these rouse less immediate apprehension than they once did because they are familiar. Perhaps they are even blessings in disguise because they win converts to the conservative cause.

Thus stability is still the keynote of business. It is the basis for the "rail market" on the stock exchange which is the feature of the week's news, and which has grown naturally out of the conspicuous efficiency with which the railroads lately have been doing their job. They are carrying the heaviest traffic in our history and maintaining a surplus of freight cars, in defiance of the tradition that car shortage is an unavoidable incident of the crop moving season. And they have so pared expenses that their earnings this year may reach or exceed, for the first time, the 5½ per cent return upon their valuation that the law contemplates.

This is good news for many millions of investors, and it is not surprising that the rail stocks have taken the torch of market leadership from the falling hands of the industrials. But it is in order to point out that the demands of labor for higher wages and of the farmers and industry for lower rates will increase proportionately with their earnings, while the "recapture clause" of the Transportation Act looms in the distance, to provide political ammunition even though it is fended off in the courts. These are facts of which the stock market will sooner or later take account, and the inevitable recession that is approaching may disturb the equilibrium when it comes.

But for the present the railroads have achieved stability. Another major industry that has reached the same goal is steel, which seems in a fair way to obliterate Andrew Carnegie's saying that it is either prince or pauper. For it has maintained for many weeks an astonishingly even output.

The automobile industry is less successful in achieving straight-line production, for it has the problem of new models to contend with, but most companies report well sustained sales, output is again increasing after the seasonal slump and most students of the market seem to think more cars will be sold this year than last. Other manufacturing activity is also at a high level and the textile industries in particular seem prosperous.

Commodity prices, too, are turning upward slightly after a long though slow decline. The index numbers and the individual markets alike yield this conclusion. Nervousness over the state of the cotton crop is fairly widespread and the next government estimate is expected to be the lowest of the season. Wheat is the only important exception, for it has declined in fear of a large Canadian crop estimate on Sept. 10. Sugar has improved considerably since the September liquidation was completed. Coffee has felt the stimulus of "crop killing." Rubber and hides also are a little better and there is some promise of higher cattle prices and of at least steady hogs. This reviving vitality in the commodity markets supplies the final assurance of active fall trade, for the turn after a decline always induces buying and the combination of crop and price prospects for agriculture is such as to promise a satisfactory business.

If any early check is in prospect, therefore, it threatens general business less than the stock market. The money markets are very firm in tone. The demand for funds has thus far been met virtually without touching the Federal Reserve reservoirs of credit, but an increase of $55,000,000 in rediscounts last week may signify that the limit of commercial bank credit is about reached. The seasonal peak in use of credit will not be passed for another six weeks and it will not be clear until later whether a check to the security markets is arising in that quarter. Brokers' loans have climbed about half way back from the May low to the January high and if commercial necessities increase banks may start to sell bonds as well as borrow from the Federal Reserve Banks. But the bond market seems able to absorb more than it is offered and prices are not much affected by firmer money.

What's Doing in Industry

With the holiday and vacation season definitely behind us, business has a free hand to accomplish some of the things that it has been promising for the past two months. Already it is apparent that the trend in sales of machinery and machine tools is upward and the volume of inquiries indicates a fall business that will be very satisfactory.

Manufacturers in New England report a slight upward movement in the volume of buying, automotive and railroad business being in evidence. In New York orders are holding a fair rate, but are scattered, and inquiries are not only plentiful but appear to be genuine.

Buying in Canada is not brisk but the outlook for fall is bright, based on the present industrial activity. In the South business is less active than earlier in the year, although present sales volume is ahead of last year.

Manufacturers and dealers in Detroit expect a turn for the better soon, as most automobile plants are planning extensive production schedules. General Motors units and more than one large truck manufacturer are mentioned as immediate buyers. Cincinnati reports a slight increase in orders and inquiries, and a good volume is assured for the fall period. Automotive accessory, furniture manufacturers and general manufacturing shops are furnishing a good market for machinery in the Indianapolis territory and sales are running quite up to expectations.

According to authentic business reports there is little to worry about in the outlook. Caution seems to be the byword and it is this caution that partly accounts for the serenity of the present condition.

The Industrial Review

Progress of the machinery and machine tool business in various parts of the country

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

New England

Manufacturers of machinery in New England report a slightly improved volume of buying during the past week. The buying came from a wide diversity of industries, with railroad and automotive lines most pronounced. In general the business of the week was regarded as of the replacement variety. The inquiry business showed good evidence of future business in the automotive and railroad industries, and some of this was judged to be for expansion purposes.

Production in Connecticut industries engaged in such products as roller bearings calls for full-time operations and in some places, such as Bristol, there are departments operating on overtime schedules.

Salesmen working out from Hartford report a good volume of business in that territory. Small tools and hand tools are in excellent demand.

New York

This market reports for the week a condition described as "spotty." Orders have been small in number and in most instances have called for single machines. Inquiries, however, are more numerous and the source and quality of these preliminaries would indicate some very promising fall business.

It is the general belief that the railroads have already done the biggest part of their buying for this year. Total purchases of machinery by the carriers has made a fairly good volume up to the present and when present quotations are accepted it is the opinion of many that the demand will fall off until new appropriations are made.

The manufacturing industries in this territory have been a little more active since the close of the summer season. Expansions are reported in more than one line and new equipment is on order. The General Electric Co., the New York Central Railroad and two of the larger locomotive and car builders are mentioned as recent buyers here. One substantial order received last week called for 9 automatic lathes, 3 jig borers and 4 profiling machines. Other equipment placed included drilling machines, die sinkers, vertical shapers and some large railroad repair shop tools.

Canada

While buying of machinery and machine tools in Canada during the past few weeks has not by any means been brisk, the outlook for fall business is promising. Much new work will be under way shortly in eastern Canadian shops, which will necessitate more tools and machinery. Other branches of the metal-working industry are unusually active, and the whole trend of the metal markets is upward both in prices and purchases. Buyers seem impressed by recent developments and are disposed to buy further ahead than recently.

Interest in the iron and steel industry continues lively, and the prospects now are that sales for the last half of the year will exceed those for the first six months. The Dominion Iron and Steel Co. announces receipt of an order for 25,000 tons of rails from the Canadian-Pacific Ry. There have also been received from private sources large orders sufficient to keep the wire and nail departments going for about four months. The Dominion Bridge Co. reports that its plant at Lachine, Quebec, is steadily increasing its output and is running extra shifts three nights a week in order to handle the increased volume of work on hand. The Canadian Car and Foundry Co., Ltd., has closed a contract with the Canadian National Ry. for 30 new coaches. A Toronto fabricating shop has work on hand sufficient to provide operation for three months and is refusing orders because of inability to give delivery.

Southern District

Though machinery and tool business is beginning to show a tendency to decline in this district, sales continue to run better than they were at this time last year, and most dealers express themselves as well satisfied with present conditions. The outlook gives promise of a better demand through September and October, than during the same two months of last year, as inquiries are unusually active from several sources.

The textile call is particularly good right now, due to the large number of new mills that are being established and to the expansion of several of the existing mills. At the present rate, 1926 bids fair to prove one of the best years in the history of the textile business insofar as machinery and equipment sales may be concerned.

Contractors and builders continue fairly active in the market, considering the lateness of the building season. Road building equipment is beginning to show a tendency to decline, but is better than it was at this time last year. In fact, 1926 has proven one of the best years in the history of the business so far as the southern territory is concerned.

Smaller shops are not buying much, and what they are taking is almost entirely in the used and rebuilt equipment field. Service stations, however, continue active buyers and it seems almost certain that 1926 will prove a record year in this respect, due to the large number of new service stations and garages that have been built in this section.

Indianapolis

A slight slump appears to have struck the machine tool and machinery trade in Indianapolis during the last two weeks. The situation is termed "spotty." In some quarters the situation is satisfactory, but in others the demand is not up to expectations. One of the quiet spots is the automobile field. Although these factories are increasing production for the fall trade, buying is held to a minimum. One reason advanced for this is the rather heavy volume of purchases made early in the year.

A big improvement is noted in demand for special machinery for the furniture factories in the state. Business booked at the midsummer shows has speeded up production and most plants are finding their facilities inadequate to take care of the increase. The volume of inquiries, however, is heavier than the actual sales volume.

A good tool demand is coming from the automobile accessory plants in this state, where business is reported good. Some inquiries are being received from the farm implement factories. The volume of demand for special machinery from brick factories remains good. New plants are to be opened before cold weather and established plants are making replacements.

Garages and repair shops continue to be good purchasers of grinding machinery and other small equipment and the demand for contractors' equipment also continues good.

Cincinnati

The prevailing opinion among the Cincinnati machine tool manufacturers and selling agents is that the market pendulum has resumed its upward swing and that there will be a gradual increase in demand for some time. In the past week a slightly greater number of orders were booked than in the previous week and a larger number of inquiries were received.

Concerns in the automotive industries placed more orders than in the previous week, but most of the orders coming from this industry called for single tools for replacement purposes.

Railroads did some scattered buying of single tools and replacements and sent in a few fair-sized lists of requirements, for quotations. A few orders came in from the electrical field and there were an increased number of inquiries from this source.

The feature of the week's market was the buying of single tools by general machinists and miscellaneous machine tool users. The orders received were scattered and diversified as to types and sizes of tools.

A slightly increased number of inquiries were sent in by prospective buyers during the week. Factory production was maintained at its previous level and manufacturing conditions continued to be favorable in every way.

Detroit

With the two summer months passed machinery and machine tools representatives in Detroit are expecting a turn for the better in the market in this city and nearby industrial centers.

Most firms report that July and August stacked up very well with the average summer months. A few found their business had exceeded that of the corresponding period in 1925. The material let-down in the number of machinery orders placed in this territory from the fast pace the industry set last fall, winter and spring appears to be drawing to a close, and prospects for increasing sales during the last third of the year are bright.

Most of the automobile plants are ordering machines here and there. The General Motors units are the heaviest buyers, taken as a whole, but most of the other plants are buying some machines to bolster up the weak departments.

Some lapping machines have been installed at the Chevrolet plant at Flint. More activity is reported at the truck factories around Detroit, especially GMC and Federal. The heavy sales of trucks this year has necessitated the purchase of considerable new equipment.

The used tool market is better than it has been for some time. Quite a sizeable order for used machines was placed this past week by the Sauzedde Corporation which recently moved from Mt. Clemens to Detroit. This consisted of slotters, shapers, milling machines, a planer and a lathe.

Some few lists of railroad tools are coming through, but buying in railroad circles has not amounted to much this summer.

Standardization of Tools Is Featured at Railway Tool Foremen's Convention

Apprentice training needed in railroad repair shops

Reports of economies made possible by standardization, the inclusion of a wider range of topics, and an attendance far surpassing that of all previous years, were the three outstanding features that characterized the fourteenth annual convention of the American Railway Tool Foremen's Association The meeting was held at the Sherman Hotel, Chicago, Sept. 1, 2 and 3. Practically all the papers presented, and the discussions that followed, were directed toward standardization or the use of economical methods of recognized standards. An exhibit of machine tools and small tools, arranged by the American Railway Tool Foremen's Supply Association and held in conjunction with the convention, attracted considerable interest.

Before adjourning Thursday's session, the election of officers took place. O. D. Kinsey, Chicago, Milwaukee & St. Paul R.R., was elected president. The other officers are: E. A. Gream, Delaware, Lackawana & Western R.R., first vice-president; W. R. Millican, Missouri, Kansas, Texas Lines, second vice-president; H. T. Jones, Oregon Short Line, third vice-president; and G. G. Macina, Chicago Milwaukee & St. Paul R.R., secretary. The new executive committee is comprised of: J. T. Jones, chairman, J. T. Sumner, W. J. Hynes, C. F. Harney, and C. A.Shaefer.

The opening address, prepared by L. A. Richardson, general superintendent of motive power, the Chicago, Rock Island & Pacific R.R. Co., was read by L. C. Bowes, production engineer of the same system.

The paper commented on the ever-increasing weight of locomotives and the increased number of special appliances used, making necessary a considerable increase in size and capacity of machine tools, as well as the demand and need for increased production and increased accuracy of production. The general trend of railroad shops in grinding and milling operations is going to mean a greater intensive analysis by toolroom men than ever before, for it is to them that the problem becomes one of extreme accuracy and close tolerancy. There are a sufficient number of special tools required at a railroad shop to take the full time of any toolroom staff. If maximum production is to be obtained, close analysis must be made to determine the special jig or fixture most economical to use. This requirement is the peculiar function of a toolroom staff, for it is only by this effort that such equipment can be developed.

In his address, President Hildebrandt stressed the purpose of promoting the welfare of the railway-shop management along the lines of tool equipment and methods to economically and properly fabricate the various parts that go to build up locomotives and cars.

The papers presented during the Convention were:

"New Labor-Saving Tools and Devices for the Air-Brake Department," by Henry Otto.

"Training of Men Suitable for Toolroom Work," by J. J. Sheehan.

"Simplification, a New Tool for the Tool Foremen," by Edwin W. Ely, assistant director, Department of Commerce.

"Standardization of Present Special Boiler Taps," by O. D. Kinsey.

"New Tools and Safety Devices for the Car Department," by G. Reichart.

"General Locomotive Shop Kinks and Devices," by J. E. Carroll.

The papers, "New Tools and Safety Devices for the Car Department," and "General Locomotive Shop Kinks and Devices," comprised a selection of blueprints and photographs, together with general descriptions.

In the paper, "Training of Men Suitable for Toolroom Work," read by J. J. Sheehan, Norfolk & Western Ry. Co., several important factors concerning the training of toolroom foremen were exemplified.

It was the author's opinion that the apprentice should spend the first six months in the toolroom to familiarize himself with the routine of work; then six months on machine work in the shop; six months in the erecting shop to see and learn how tools are used in actual service; six months in the treating of steel, and the remainder of the time in the toolroom. A simple system of grading, whereby one apprentice is kept informed as to the progress he is making as compared to other apprentices on similar jobs, is beneficial.

A man must think, acquire, control and store knowledge. If he looks around him, he sees it is the man who has worked hard and faithfully who succeeds. What men need above all things are initiative, creative ideas, and definite plans of action, to which they apply themselves with vigor.

It is necessary, in order to insure the making of a good toolroom apprentice, that there be a perfect understanding and co-operative feeling between the apprentice and his foreman so that there will be no lost motion, or wasted effort.

Mr. Ely's paper, dealing with simplification, was accompanied by slides. An outline of what the department of commerce has done in various industries was illustrated. Mr. Ely stated that simplification in practice means the reduction of variety in sizes, dimensions and immaterial differences of everyday commodities as a means of eliminating waste and decreasing costs, and increasing profit in production, distribution and consumption.

One of the most interesting papers of the convention was, "Standardization of Present Special Boiler Taps." It was prepared by a committee consisting of O. D. Kinsey, A. H. Gray, G. L. Nelson, F. H. Kreuger, and S. H. Ehrenstein. The standards committee of the American Tap and Die Association assisted in developing the recommended standards. Tapered boiler taps, washout taps, flexible stay-bolt taps, tapered-head, radial tap and reamer, wagon-top pilot radial taps, spindle stay bolt taps, combination stay-bolt taps, and combination radial stay-bolt taps were included in the report. With the exception of the provision of an undercut directly in back of the threaded portion of the boiler taps, and increasing the square shanks from 1¼ to 1½ in. on the larger sizes of washout taps, the specifications and sizes were adopted and accepted by the association as a recommended standard.

The supply division elected the following officers.

W. R. Mau, president; F. A. Armstrong, secretary-treasure; and M. J. Kearins, E. H. Lunde, H. W. Layton, on the executive board.

The exhibitors were:

Edgar Allen Steel Co., Inc., Armstrong Blum Manufacturing Co., Armstrong Bros. Tool Co., Arrow Tools, Inc., Ashton Valve Co., E. C. Atkins & Co., The Atlas Steel Corporation.

John Bath & Co., Chas. H. Besly & Co., Borden Co., Brown & Sharpe Manufacturing Co., W. L. Brubaker & Bros. Co., Buckeye Portable Tool Co., A. M. Byers Co.

Chicago Pneumatic Tool Co., Clark Equipment Co., Clark Manufacturing Co., Cleveland Pneumatic Tool Co., Cleveland Steel Tool Co., Cleveland Twist Drill Co., Colonial Steel Co., Crucible Steel Co. of America, Cushman Chuck Co.

Davis Boring Tool Co., The Desmond-Stephan Co., Duff Manufacturing Co., Henry Disston & Sons, Inc.

Eclipse Interchangeable Counterbore Co.

J. Faessler Manufacturing Co., Federal Machinery Sales Co., Firth-Sterling Steel Co.

Gairing Tool Co., Goddard & Goddard Co., Greenfield Tap and Die Co.

Hubbard & Co., Husky Wrench Co.

Independent Pneumatic Tool Co., Ingersoll Milling Machine Co., Ingersoll-Rand Co., International Railway.

Jones & Lamson Machine Co., Joyce-Koebel Diamond Co.

Wm. H. Keller, Inc., Kelly Reamer Co., King Pneumatic Tool Co.

The Latrobe Tool Co., The Lawson Manufacturing Co., Lovejoy Tool Works, Lyon Metallic Manufacturing Co.

Machine Tool Record, MacLean-Fogg Lock Nut Co., Manning, Maxwell & Moore, Inc., Marshall & Huschart Machinery Co., Morse Twist Drill & Machine Co.

National Tool Salvage Co., Norton Co., A. O. Norton Co., Nye Tool & Machine Co.

O. K. Tool Co., Oster Manufacturing Co.

Pratt & Whitney Co.

Racine Tool and Machine Co., *Railway Mechanical Engineer, Railway Journal, Railway Purchaser and Stores, Railway Review,* Rich Tool Co., Ridge Tool Co.

Simonds Saw & Steel Co., Snap-On Wrench Co., Standard Tool Co., Sterling Products Co.

Templeton Kenly & Co.

Union Manufacturing Co., Union Twist Drill Co.

Vanadium-Alloys Steel Co.

The Welding Engineer, Wetmore Reamer Co., Whitman & Barnes Manufacturing Co., and Wilson-Maeulen Co.

Bingham Urges S.A.E. to Educate Public on Aviation

Air-cooled engines for aircraft came into their own at the first session of the aeronautic meeting of the S.A.E. at the Bellevue-Stratford Hotel in Philadelphia last week. Commander E. E. Wilson, U.S.N., presented a paper outlining the development of air-cooled engines for use in Navy aircraft of various kinds and giving interesting details of the tests made with various types of air-cooled engines. He pointed out the advantage of the air-cooled engine, the weight being of particular importance in affecting useful load, landing speed etc., as well as the advantages of the short, radial engine in plane construction. Both the Wright and Pratt & Whitney engines received very favorable comment.

E. T. Jones, of the Wright Aeronautical Corporation, told of the advances and achievements of the radial air-cooled engines built by that company.

FEATURES OF AIR-COOLING

George J. Mead, chief engineer of the Pratt & Whitney Aircraft Co., outlined the problems presented by the demand for large air-cooled engines and described how these had been solved to the satisfaction of all concerned. Higher speeds and greater compression were adopted, together with a form of crankshaft that lent itself to the severe conditions imposed. The construction of this engine includes many novel features, including a high-speed impeller to assist in completely filling the cylinders. A double carburetor is used, in connection with an impeller running at five times crankshaft speed.

A second session was devoted to planes, the first paper being by Dr. Adolph Rohrbach on the "Economical and Rapid Production of All Metal Planes." Short papers were also presented by E. A. Stenson and A. V. Verville on "Airplanes for Individual Ownership."

The Air-Transport Session opened with remarks by W. B. Stout and had papers on "Night Flying" by W. L. Smith, of the Air Mail Service; "The Illumination of Air Routes," by C. T. Ludington and H. C. Ritchie, and "Directional Radio," by Capt. W. H. Murphy and Lt. L. M. Wolfe, of the Army Air Service. There was also an inspection trip to the Naval Aircraft Factory.

The banquet was well and enthusiastically attended. Grover C. Loening was toastmaster. Dr. Geo. E. Lewis, head of the National Advisory Committee for Aeronautics, outlined the research work of his committee. Senator Bingham, father of the new air legislation, pointed out the need of educating the public to the facts concerning air navigation and that this can be done by engineers through their local press. He urged that people be made to realize that the present air program did not include the necessary appropriations. Unless the appropriation committee is impressed with the desire of the public that this program be carried out, the money may not be forthcoming. The Government must also provide navigation facilities, such as emergency landing fields and beacons, as it does for marine work. Airports must be provided by the cities.

Assistant Secretaries Davidson, Warner and McCracken each spoke of their work in the Army, Navy and commercial work. Each pointed out the problems and methods that were being pursued. Mr. Warner struck a keynote in urging the necessity for reasonable specifications.

Personals

H. M. GRAHAM has been appointed chief engineer for the Ross Heater and Manufacturing Co., of Buffalo.

C. R. RUPP has been appointed general manager of the Aetna Iron and Steel Co., of Jacksonville, Fla.

JOHN J. COLEMA has been appointed general manager of Thos. Firth & Sons, Inc., of Hartford, Conn.

DR. F. H. HIRSCHLAND has been elected president of the newly organized Chromium Corporation of America.

R. E. ROCHE has joined the staff of the De Laval Steam Turbine Co., at Chicago. He was formerly associated with the Elliot Co.

E. I. VAN DOREN, of 206 Times Bldg., Troy, N. Y., has been appointed district sales agent in that territory for the Burke Electric Co., of Erie, Pa.

F. W. ANDREW, formerly chief engineer for the Eisemann Magneto Co., is now associated in a similar capacity with the Mitchell Specialty Co., Holmesburg, Pa.

CHARLES J. MCPHILLIPS has joined the sales staff of Herman L. Winterer, machinery dealer, of Philadelphia. He was formerly connected with the machine tool department of Frank Toomey, Inc.

CHARLES H. ALVORD has resigned as president of the Hendey Machine Co., of Torrington, Conn. Mr. Alvord had been associated with the company since 1896 and had been president since 1919.

DEANE S. HAZEN has been appointed assistant sales manager of the W. L. Brubaker & Bros. Co., and will be located at the company's New York office, 59 Church St. Mr. Hazen was formerly associated with the National Acme Co., of Cleveland.

FARRAND HALL, district sales manager in Cleveland for the Carborundum Co., of Niagara Falls, N. Y., has been transferred to the sales department at the main plant. He has been succeeded in Cleveland by Harry Collinson, who was transferred from the Milwaukee office. Carl J. Steuber has been appointed district manager in Milwaukee.

Business Items

The Cleveland Tractor Co. has moved its San Francisco office to 1345 Howard St.

The Box Crane and Hoist Co., of Philadelphia, is the new name for the old firm known as Alfred Box & Co., Inc.

The Schmidgall Tool Co., of Peoria, Ill., has changed its name to the Schmidgall Manufacturing Co.

The Hall Planetary Co. is the new name of the Hall Planetary Thread Milling Machine Co., of Philadelphia.

The sale of the Ansted Engineering Co.'s buildings and real estate at Connersville, Ind., to the Auburn Automobile Co., of Auburn, has been approved by the courts. The Ansted company has been in receivership for the past three years. The plant will be used in expanding Auburn facilities.

The Carle Machinery Co., which has taken over the plant of the Imperial Drop Forge Co., of Indianapolis, is located at 546 E. Woodbridge Ave., Detroit.

The American Brown-Boverie Electric Corporation, of New York, has opened a branch office at 922 Witherspoon Bldg., Philadelphia. L. T. Peck is the manager.

The Crane Puller Co. announces the removal of its plant and offices from South Deerfield, Mass., to Waltham, Mass. The company has found that the former location was too far from main traffic lines.

The Timken Roller Bearing Co., of Canton, Ohio, has purchased the plant and business of the Bock Bearing Co., of Toledo. The transfer of the property has not been formally made, but this will be done within a short time.

The Brownell Machinery Co., of Providence, R. I., has been appointed exclusive sales agent in Rhode Island, and in Bristol County, Mass., and in New London and Windham Counties in Connecticut, for the Cleveland Planer Co., of Cleveland.

The Rudel-Ryder Machinery Co. is the new name of the old Rudel-Belnap Machinery Co., of Montreal and Toronto. C. M. Rudel is president and Lieut.-Col. T. E. Ryder is vice-president. There is no change in the organization personnel or policies of the company.

Arthur Jackson, of Toronto, Canada, direct factory representative for several American machine tool manufacturers, has opened a branch office at 437 Grosvenor Ave., Montreal, Canada. This office will be under the management of Victor Larson, who was formerly connected with the Canadian Ingersoll-Rand Co.

Forthcoming Meetings

Machine Tool Exhibit. Sixth annual exhibition of machine tools at the Mason Laboratory, Yale University, under the auspices of the New Haven Section, A.S.M.E., the mechanical engineering department of the Sheffield Scientific School, and the New Haven Chamber of Commerce, Sept. 7 to 10. Administrative office, New Haven Machine Tool Exhibit, 400 Temple St., New Haven, Conn.

International Railway General Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 7 to 10. William Hall, secretary, 1061 West Wabash Ave., Winona, Minn.

American Society for Steel Treating. Eighth national steel and machine tool exposition, Municipal Pier, Chicago, Sept. 20 to 24. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

Society of Automotive Engineers. Annual production meeting, Hotel Sherman, Chicago, Sept. 21, 22 and 23. John Warner, manager of meetings department, 29 West 39th St., New York.

American Foundrymen's Association. Second international foundrymen's congress, Detroit, Sept. 27 to Oct. 1, under the auspices of the American Foundrymen's Association. R. E. Kennedy, secretary, 909 W. California St., Urbana, Ill.

National Association of Manufacturers. Thirty-second annual meeting, Waldorf-Astoria Hotel, New York, Oct. 5, 6 and 7. George S. Boudinot, secretary, 50 Church St., New York.

American Gear Manufacturers Association. Semi-annual meeting, Briarcliff Lodge, Briarcliff Manor, N. Y., Oct. 14, 15 and 16. T. W. Owen, secretary, 2443 Prospect Ave., Cleveland, Ohio.

National Safety Council. Fifteenth annual safety congress, Detroit, Mich., Oct. 25 to 29. A. A. Mowbray, director, 108 East Ohio St., Chicago.

American Welding Society. Eighth annual fall meeting, in conjunction with International Welding and Cutting Exposition, Broadway Auditorium, Buffalo, N. Y., Nov. 16 to 19. Secretary's headquarters, 29 West 39th St., New York City.

The Weekly Price Guide

Rise and Fall of the Market

IRON-DEMAND, though active, is confined to small tonnages; prices are firm for all grades except basic; production continues heavy. Steel output and demand are unseasonally great. Most of the buying is for construction automotive and railway use. Steel pipe and automobile sheets are also moving in fairly large volume. Prices of the principal hot-rolled steel products hold at last week's levels of $2 per 100 lb. on bars and shapes and $1.90 for plates (base sizes on all three) in carload lots, f.o.b. Pittsburgh mills. On bars and shapes the $2 figure applies on 100-ton quantities or over; smaller lots go at $2.10. Furnace coke at Connellsville is down 15 to 25c. per ton and New York dealers' buying prices of scrap brass and copper are lower, comparing current quotations with the Aug. 27 levels.

(All prices as of Sept. 3)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.19
Northern Basic	20.39
Southern Ohio No. 2	21.39
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	21.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	22.76
Virginia No. 2	28.67
Basic	21.26
CHICAGO	
No. 2 Foundry local	21.75
No. 2 Foundry, Southern (silicon 2.25@2.75)	25.05
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	19.76
Basic	19.76
Bessemer	19.76

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	5.00@5.25
Cleveland	5.00@5.25
Cincinnati	5.00@5.50
New York	5.25@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.25@2.30	3.89	3.15	3.50
No. 12	2.30@2.35	3.94	3.20	3.55
No. 14	2.35@2.40	3.99	3.25	3.60
No 16	2.45@2.50	4.09	3.35	3.70
Black				
Nos. 18 to 20	2.90@2.95	4.30	3.65	3.90
Nos. 22 to 24	2.95@3.00	4.35	3.70	3.95
Nos. 26 and 27	3.00@3.05	4.40	3.75	4.00
No. 28	3.10@3.15	4.50	3.85	4.10
Galvanized				
No. 10	3.20@3.30	4.65	4.00	4.25
Nos. 12 to 14	3.30@3.40	4.75	4.10	4.35
No. 16	3.45@3.55	4.90	4.25	4.50
Nos. 18 to 20	3.60@3.70	5.05	4.40	4.65
Nos. 22 to 24	3.75@3.85	5.20	4.55	4.80
Nos. 26 and 27	3.90@4.00	5.35	4.70	4.95
No. 28	4.20@4.30	5.65	5.00	5.25

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded	48%	35%	53½%	40½%	51%	38%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36-5% off.

Size, Inches	List Price per Foot	Diameter in Inches — External	Diameter in Inches — Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at warehouse in lots of less than 100 ft.:

Thickness — Decimal	B.W.G. and Fractions	Outside Diameter in Inches — ¼	⅜	½	⅝	1	1¼	1½
		Price per Foot						
.035"	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049"	18	.17	.18	.19	.20	.21	.23	.25
.065"	16	.19	.20	.21	.22	.23	.25	.27
.083"	14	.20	.22	.23	.24	.25	.27	.29
.095"	13	.21	.23	.25	.26	.27	.29	.31
.109"	12	.22	.24	.26	.27	.28	.30	.32
.120" or .125"	11	.23	.25	.27	.28	.29	.31	.33
.134"	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Spring steel (light) (base)*	7.00	6.00@7.50	4.65†
Spring steel (heavier)	4.00	....	4.00
Coppered Bessemer rods (base)	6.05	6.00	6.20
Hoop steel	4.49	3.65	4.15
Cold rolled strip steel	6.25	6.35	6.25
Floor plates	5.25	5.30	5.00
Cold drawn shafting or screw	4.00	3.90	3.60
Cold drawn flats, squares	4.50	4.40	4.10
Structural shapes (base)	3.34	3.10	3.10
Soft steel bars (base)	3.24	3.00	3.00
Soft steel bar shapes (base)	3.24	3.00	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.20	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, 3/32, 8.35c.; ⅛, 7.85c.; 5/32 to ½, 7.35c. per lb. *Flat, 1/16@¼-in. thick. †F.o.b. cars.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			15.62½
Tin, 5-ton lots, New York			67.50
Lead (up to carlots) E. St. Louis	8.65	New York	9.50
Zinc (up to carlots) E. St. Louis	7.40	New York	8.37½

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	19.00	20.50	17.00
Copper sheets, base	23.00	23.00	23.00
Copper wire, base	20.00	20.00	16.50
Copper bars, base	22.62½	22.62½	22.50
Copper tubing, base	25.00	25.00	25.00
Brass sheets, base	19.37½	19.37½	19.37½
Brass tubing, base	24.25	24.25	23.75
Brass rods, base	17.12½	17.12½	17.12½
Brass wire, base	19.87½	19.62½	19.87½

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1 to 15 ton lots	27.00	27.00	27.02
Zinc sheets (casks)	13.25	12.55	12.01
Solder (½ and ½), (case lots)	41.12½	42.50	38½@42½
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			82.00
Commercial genuine, intermediate grade			56.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			14.75
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 35.00 Electrolytic 39.00 Shot 36.00			

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	35.00
Blocks	32.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Hot rolled sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	12.37½@12.62½	11.50	11.25@11.75
Copper, heavy, and wire	11.62½@12.12½	11.75	10.75@11.25
Copper, light, and bottoms	10.00 @10.37½	10.00	9.50@10.25
Heavy lead	7.50 @ 7.75	7.00	7.00@ 7.50
Tea lead	5.50 @ 6.00	5.00	6.00@ 6.50
Brass, heavy, yellow	7.25 @ 7.50	7.50	7.25@ 7.75
Brass, heavy, red	9.50 @10.00	9.75	9.00@ 9.50
Brass, light	6.00 @ 6.25	6.00	6.75@ 7.25
No. 1 yellow rod turnings	8.25 @ 8.50	8.00	7.75@ 8.25
Zinc	4.25 @ 4.75	4.50	4.25@ 4.75

TIN PLATES—American Charcoal—Bright—Per box

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
Coke Plates—Primes—Per box				
100-lb.,	14x20	6.45	6.10	7.00
Terne Plates—Small lots, 8-lb. Coating—Per box				
IC,	14x20	7.75@8.00	6.95	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.13@0.17½	$0.18	$0.15
Cotton waste, colored, per lb.	.10@ .14	.14	.12@.17
Wiping cloths, washed white, per lb	.17½	36.00 per M	.15
Sal soda, per 100 lb. keg	2.05	2.25	2.75*
Roll sulphur, per 100 lb.	2.70†	3.50	4.25‡
Linseed oil, per gal., 5 bbl. lots	.95½	1.05	.92
Lard cutting oil, 25% lard, per gal.	.55	.50	.48
Machine lubricant, medium-bodied (55 gal. metal bbl.), per gal.	.35	.35	.29
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	40–5%	40–5%	40–5%
Heavy grade	30–10%	30–10%	30–10%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50%	50–10%	50%
Second grade	50–10%	60–5%	50–10%

*Per 175 lb. keg. †In 150-lb. bags. ‡Per 425 lb. barrel.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0324
Cold drawn shafting	per lb.	.04	.04	.0415
Brass rods	per lb.	.17½	.16½	.16½
Solder (½ and ½)	per lb.	.41½	.41	.395
Cotton waste	per lb.	.13@.17½	.13@.17½	15@22
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	7.00
Emery disks, cloth, No. 1, 6 in. dia.	per 100	3 10	3.55	3.55
Lard cutting oil	per gal.	55	.55	.55
Machine oil	per gal.	.35	.35	.35
Belting, leather, medium	off list	40–5%	40–5%	40%
Machine bolts, up to 1x30 in.	off list	40%	40%	40%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$5.40	$5.84	$5.65
Emery paper	10.71	11.00	10.71
Emery cloth	27.84	31.12	29.48
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.32	1.45	1.49
Cloth	3.10	3.55	3.20
Fire clay, per 100 lb. bag		.60	.75
Coke, prompt furnace, Connellsville	per net ton		3.25@ 3.50
Coke, prompt foundry, Connellsville	per net ton		4.25@ 5.00
White lead, dry or in oil	100 lb. kegs	New York, 15.25	
Red lead, dry	100 lb. kegs	New York, 15.25	
Red lead, in oil	100 lb. kegs	New York, 16.75	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1½ and 1½x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{5}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x½-in., $1.00 per 100. List plus 35% at New York warehouses.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x½-in., 2c. each. Discount 70% for $\frac{5}{16}$-in and smaller and 65% for ⅜-in. and larger.
Case hardened ½x½-in., 6c. each, less 50%.

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2$\frac{5}{16}$-in. to 4½-in $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{5}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1½ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ¾-in. dia., 75c; 1-in. long and shorter, 75c.; longer than 5-in., 50c.; less than 200 lb. 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Mass., Boston—E. L. Sturtevant, 322 Tappan St., Brookline—tools and equipment for proposed $300,000 garage on Gainsboro St.

Mass., Cambridge (Boston P. O.)—Lesser & Levine, 43 Holburn St., Roxbury.—miscellaneous tools and equipment for proposed garage on Main St., here. Estimated cost $125,000.

Mich., Detroit—Commerce Pattern Fdry. & Machine Co., 2211 Grand River Ave.—equipment for enlarging foundry and machine shop.

Mich., Detroit—A. Mann, 13231 Terry Ave.—one 12 in. or 14 x 6 in. quick change engine lathe.

N. J., Jersey City—G. Watson, 66 Waverly St.—One 8 ft. cornish brake.

N. Y., New York—S. Langsdorf & Co., 72 Spring St.—oval chuck.

O., Cleveland—White Motor Co., 842 East 79th St.—screw machines and lathes.

Pa., East Pittsburgh—Westinghouse Electric & Manufacturing Co.—2 speed lathes, 1 punch press, 1 shear, 2 tapping machines and 1 vertical milling machine.

Pa., Pittsburgh—Pittsburgh and Lake Erie R.R. Co., Smithfield St., C. M. Yohe, Purch. Agt.—one 90 in. driving wheel quartering machine; 1 double frame 60,000 lb. forging hammer,

W. Va., Wheeling—Warwood Tool Co.—Brinell hardness testing machine.

Wis., Fort Atkinson—J. G. Shodron, R. W. Albertson, et. al.—machine tools for new plant for manufacture of auto accessories.

Wis., Kenosha—Nash Motors Co., Edward St., C. W. Nash, Pres.—machine tools, including millers, lathes, etc.

Que., Montreal—J. A. Constantin, 4474 De la Roche St.—complete equipment for automobile repair shop.

Que., St. Roche de L'Agichan—S. Laramee.—lathe, drill press, miscellaneous tools, etc. for garage and auto repair shop.

Opportunities for Future Business

Calif., Los Angeles—Pacific Housewares Co., c/o Ashley & Evers, Archts., 525 Market St., San Francisco awarded contract for the construction of 3 story factory, on Factory Pl. $150,000.

Calif., Oakland—Atlas Heating & Ventilating Co., 557 4th St., San Francisco is having plans prepared for the construction of 1 story shops building at Louise and 32nd Sts. Estimate cost $40,000. Private plans.

Ill., Chicago—Economy Pumping Machinery Co., 122 Curtis St., awarded contract for the construction of 1 and 2 story, 100 x 177 ft. factory, at 3431 West 48th St. Estimated cost $60,000. Noted Aug. 19.

Ill., Chicago—Pullman Co., Adams and Michigan Aves. awarded contract for the construction of 1 story manufacturing plant, on Langley Ave. between 111th and 115th Sts. Estimated cost $1,000,000.

Mass., Dorchester (Boston P. O.)—M. Brown, 294 Washington St. awarded contract for the construction of 1 story, garage and repair shop on Blue Hill Ave., here. Estimated cost $150,000.

Mass., Lynn—Thompson Electric Welding Co., 161 Pleasant St., is receiving bids for the construction of 1 story addition to factory on Pleasant St. Estimated cost $40,000. H. M. Haven and A. T. Hopkins, 11 Beacon St., Engrs.

Mass., Salem—J. S. Sawyer, c/o W. H. Hunt, Archt., 197 Washington St. awarded contract for the construction of repair and service garage. Estimated cost $50,000. Noted Aug. 19.

Mass., South Boston (Boston P. O.)—Old Colony Realty Co., c/o J. D. Marr, 384 Dorchester Ave., will build 1 and 2 story, 195 x 200 ft. garage on Old Colony Ave., and D St. Work will be done by separate contracts. Estimated cost $175,000.

Dear Reader:

If you don't get the order when you follow up the sales leads on this page it may be because of competition by others using the same leads. Concerning one item, a manufacturer wrote us as follows:

"....We have certainly been flooded with inquiries and salesmen calling."

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BUSINESS NEWS DEPARTMENT,
McGRAW-HILL CO., INC.,
10th Ave. at 36th St., New York.

Mass., South Hadley—Electric Light Dept. awarded contract for the construction of 1 story service and repair building. Estimated cost $40,000.

Mo., St. Louis—St. Louis Coffin Co., 1821 Chouteau Ave., awarded contract for the construction of 2 story, 50 x 125 ft. addition to coffin factory, on Chouteau St. Estimated cost $45,000.

N. Y., Brooklyn—Ridgewood Garage Co., 322 St. Nicholas Ave., is having plans prepared for the construction of 2 story, 50 x 100 ft. service building, repair shop and garage. Estimated cost $60,000. H. C. Brucker, 2424 Myrtle Ave. Archt.

N. Y., Long Island City—C. Proescher, 84 8th Ave. awarded contract for the construction of 2 story, 50 x 120 ft. sheet metal works, on 40th Ave., here. Estimated cost $50,000.

N. Y., Syracuse—Continental Can Co., Syracuse, is having plans prepared for the construction of 2 story, addition to plant, here. Estimated cost $150,000. Francesco & Jacobus, 511 5th Ave., New York City, Engrs. and Archts.

N. Y., Valley Stream—Hendrickson Bros., Inc., Central Ave., is having plans prepared for the construction of a 1 story garage. Estimated cost $45,000. J. J. Gunther, National Bank Bldg., Far Rockaway, Archt.

N. Y., Valley Stream—J. Walbroehl, is having plans prepared for the construction of 1 story, garage at Merrick Rd. and Fletcher Ave. Estimated cost $40,000. J. J. Gunther, National Bank Bldg., Far Rockaway, Archt.

N. Y., White Plains—Gramatan Hotel, Pondfield Rd., awarded contract for the construction of 3 story, 125 x 335 ft. garage and service station, on Tibbets Ave. Estimated cost $300,000.

O., Canton—Timken Roller Bearing Co., awarded contract for the construction of locomotive roller bearing plant, on Garfield Ave. S. W. Estimated cost $1,000,000. Noted Aug. 5.

O., Cleveland—Chair Products Co., F. G. Hodell, Pres., 3924 Cooper Ave. is having plans prepared for the construction of 2 story, 55 x 144 ft. factory, on Cooper Ave. Estimated cost $60,000. Carter Richards Co., Engineers Bldg., Engr. and Archt.

O., Cleveland—Cleveland Switchboard Co., c/o F. C. Hafemeister, Pres. and Genl. Mgr. 2925 East 79th St., awarded contract for the construction of 1 story, 30 x 140 ft. factory addition, at 2924 East 79th St. Estimated cost $40,000. Noted Aug. 12.

O., Cleveland—Reliance Electric & Engineering Co., 1088 Ivanhoe Rd., C. L. Collens, Pres. awarded contract for the design and construction of 2 story, 40 x 80 ft. addition to plant for the manufacture of electric motors to Austin Co., 16112 Euclid St.

O., Columbus—Civic Investment Co., 88 North Front St., awarded contract for the construction of 1 story, 62 x 183 ft. garage, at Front and Spring Sts. Estimated cost $75,000.

O., Columbus—International Harvester Co., Chestnut and Water Sts., L. H. Lightcop Mgr. awarded contract for the construction of 4 story, 150 x 170 ft. garage and service station, on Chestnut St. Estimated cost $150,000.

O., Jackson—G. Clark, is having plans prepared for the construction of 2 story, 35 x 100 ft. repair garage on Portsmouth St. Estimated cost $50,000.

O., Lakewood—J. W. Chrisford, 1452 Highland Ave. had plans prepared for the construction of 50 x 200 ft. garage on Detroit Ave. Estimated cost $100,000. Private plans.

Pa., Rochester—Guarantee Liquid Measure Co. is receiving bids for the construction of 1 story, 360 x 360 ft. manufacturing plant, here. Estimated cost $150,000. Private plans. Noted Aug. 26.

Pa., Sharon—Westinghouse Electric & Manufacturing Co., Pittsburgh, awarded contract for the construction of 1 story, 40 x 101 ft. and 5 story 70 x 221 ft. factories, here.

Tex., Amarillo—W. S. Rule, awarded contract for the construction of 8 story, 50 x 140 ft. office and garage building at 3rd and Polk Sts. Estimated cost $750,000.

Wis., Kenosha—Nash Motors Co., Edward St., C. W. Nash, Pres. is receiving bids for the construction of 1 story, 100 x 600 ft. addition to factory. Estimated cost $100,000. Private plans.

Wis., West Bend—West Bend Aluminum Co., awarded contract for the construction of 1 and 3 story, 98 x 192 ft. addition to factory, here.